

CHRONICA HORTICULTURAE

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Horticultural Highlights

A Whole Foods Plant Based Health Perspective, an Opportunity for Horticulture?

- Urban Horticulture and Green Open Space
- Sustainability of Intensive Vegetable Farming in the Up-Country Region of Sri Lanka

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Cover photograph: View of downtown Brisbane from Roma Street Parkland. Photograph by Yves Desjardins. See article p. 9.





From Vision to Reality: Horticulture at the Forefront of Innovation

Georg J. Noga, ISHS Treasurer



Georg J. Noga

Appreciation of horticultural sciences in most industrialized western countries is declining and respective departments and institutes are being eroded or resources shifted to other disciplines, e.g. molecular biology. This is despite the steady increase in demand for high quality, nutritious and safe food, including fruits and vegetables. So what is the explanation for this disappointing discrepancy between real value and such poor perception of our profession? Do we need to market our profession and our accomplishments much better, or, as one of my colleagues from Africa recently recommended: make a lot of noise!?

The risks associated with global climate change and the probability of extreme weather conditions such as drought, heavy rainfalls causing floods, hail, low temperatures or frost have all increased dramatically and are causing challenges for horticulturists. Based on our scientific efforts and accomplishments, we have developed sophisticated closed systems with better control of environmental conditions and have optimized other types of protected cultivation (crops under hail nets and plastic film) that require high capital investment for growers.

When giving a tour through my research station about 10 years ago, on the occasion of an Open Day, I noticed the **fascination** of the visitors when demonstrating our systematic approach for growing sweet cherry in a greenhouse. This was done to avoid the impact of adverse climate conditions. I also stressed the enormous challenges we encountered at the beginning of this project, including marginal ventilation and climate control, unsatisfactory bee pollination, reduced light penetration through glass and films, excessively vigorous rootstocks, etc.

I also stressed the enormous progress we had made through interdisciplinary collaboration and **innovation** that finally offered an optimized system to growers and entrepreneurs yielding double the price for produce because it was 10-14 days earlier on the market than competitors using traditional production systems. This reflects the fascination about horticultural sciences. We are bringing **visions to reality**. We have to market such success stories much better than we have in the past! Fantastic opportunities are opening up with development of new technologies. We are facing great opportunities for implementing these innovations for the benefit of our industry, consumers and mankind.

During the tour of our facilities, I mentioned understanding and controlling plant growth and plant-environment interactions in such closed systems is now fundamental for off-earth missions. On missions to the moon and at the International Space Station, astronauts have produced their own tomatoes and strawberry fruits, wheat, rice, and herbs, and even grew fir tree seedlings in an environmental system called the "VEGGIE" (Figs. 1-3). Long-term venture to Mars, or beyond, will continue to use these sophisticated closed-system approaches, considering complete recycling of minerals, gasses produced, and biological materials. And what would that be good for, except wasting huge amounts of money that could be used to solve urgent problems on earth? Most people don't understand that this type of research indeed will help us to solve future problems and challenges on earth. "Growing apples on Mars" is in planning. Innovative systems of modern plant tissue culture, as well as age-old systems such

as Bonsai, will play a role in the development of self-contained systems for off-earth fruit tree production. Plant factories and closed-systems farming on earth, have and will unquestionably continue to benefit from present and future space research.

One closed-system farming technique now in use is called "vertical farming". The new application for this urban plant production system dates back to 1999, though the original idea for urban horticulture dates back to the hanging gardens of Babylon. This farming system envisages sustainable plant production within multi-story sky-scrapers or other large buildings, changing them into "farmscrapers" (Figs. 4-5). Production is frequently based on soilless culture and cycling of matters under greenhouse conditions including artificial lighting. Because of the proximity of such production sites to the consumers, costs of transportation and handling are minimal. Fresh horticultural produce would be made available shortly after harvest. By shortening the food supply chain to the absolute minimum, postharvest losses could be reduced significantly.

One of the convincing advantages of vertical farming is that fruit and vegetables, as well as mushrooms, medicinal plants and flowers could be produced continuously throughout the year. Calculations of the increase of annual

Figure 1. LED light panel for VEGGIE plant growth unit being built for the International Space Station. Photo courtesy of NASA Kennedy Space Center.

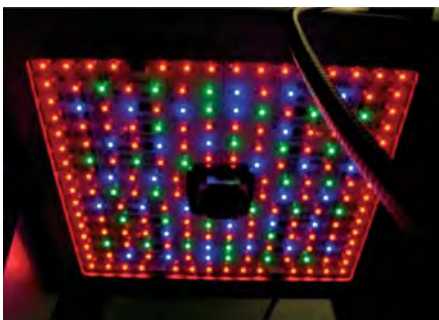


Figure 2. Collapsible VEGGIE plant growth unit proposed for spaceflight testing. Photo courtesy of NASA Kennedy Space Center.

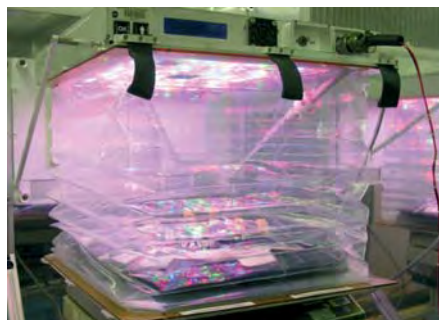


Figure 3. Rooting "pillows" for passive watering with VEGGIE system. Photo courtesy of NASA Kennedy Space Center.



Figure 4. Vertical farming: Innovative concept for sustainable horticultural production associated with fresh produce sales stores. Illustration: PlantLab R&D, NL.



plant productivity range from 4-6-fold for leafy vegetables to almost 30-fold for strawberries. To provide 200 g of fresh fruit and vegetables per day per person all year, tentatively one m² of plant growth space would be needed. For a city like Bonn, my home town, with 320,000 citizens, it is estimated that a plant factory with 10 levels and a ground space of about 180 x 180 m would be needed. This is impressive when related to the supply of fresh and healthy products. In mega cities vertical farming will be an essential element to feed the urban citizens and to reduce CO₂ emissions (food steps vs. food miles).

In vertical farming, plants are well-protected from adverse climate. Pesticide application would be kept to a minimum. What great per-

Figure 6. Growing sweet pepper in a plant growth unit employing the latest LED technology. Photo: G. Noga.



Figure 5. Plant factory as multi-storey construction. Illustration: PlantLab R&D, NL.



spectives in times of food scandals and major food safety concerns!

Such closed systems are impressive in terms of resource efficiency. Nutrients and water may be added based on the needs of the plants and their developmental stage. In hydroponic systems, these resources may be circulated and re-used after cleaning and disinfecting the percolating nutrient solution. Water demand for plant production could be reduced by up to 90% and contamination of groundwater, soil and atmosphere with nutrients and agrochemicals minimized. On a global basis almost one third of the soil degradation is now caused by agricultural activities. However, agricultural land and other resources would not be depleted by vertical farming. So vertical farming employing closed systems is good news in times when land is being degraded by salinity, sodicity and alkalinity, and water tables are being over-exploited by far exceeding recharge in many regions of the world. Surprisingly, for these marginal regions, vertical farming would reveal new perspectives, even under adverse climate conditions, such as in hot and arid regions, and in the middle of the desert.

Some call vertical farming the smarter way of growing plants. Vertical farming opens up fantastic opportunities for robotics and automation from the seed/seedling to the harvest stage, and also for subsequent sorting and packing. Robots for cutting roses or cucumber and placing them in cartons, are already in place in some advanced greenhouse industries. In addition, sensor technology for early detection and differentiation of biotic and abiotic stress is rapidly developing. In some cases non-invasive techniques with an intriguing temporal and spatial resolution make stress or infections visible long before macroscopic symptoms become apparent. Logically, it follows that early identification of such biotic stress should consequently be paralleled by target-oriented, effective control of pests and diseases, e.g. by single droplet application of pesticide solution to those small-scale sites where infection potential is just building up. In other words: it is possible that sensing and acting in parallel, at a precision

Figure 7. Plant growth unit employing LED grow lights. Photo: PlantLab R&D, NL.



and efficacy not achieved to date, will become a reality within the next few years.

However, there is also criticism that vertical farming requires large capital investments and that such enterprises will never become commercially viable. Energy costs, mainly for lighting, to operate such a plant factory are regarded as the main bottleneck. But LEDs are the key to future success. We have seen a significant drop in LED prices within the last few years, and this development will continue, paralleled by an increase in efficiency of LED grow lights that generate specific wavelengths (Figs. 6-7). Currently, LEDs operate with an efficiency of only 28%. To advance a plant factory to the economic stage, the efficiency of LEDs needs to be doubled. There are rumors that this has been accomplished already by one of the world's leading LED manufacturers. So the future has begun! And we are part of it. One thing is for sure: When considering a mission to the moon or to Mars, horticulture definitely will be on board! Who else other than horticulturists could provide such fundamental knowledge and expertise on plants, product and process quality?

With this fantastic perspective, I finish this reality-oriented vision by taking the opportunity to convey my best greetings to all ISHS members and their families, and to wish them a wonderful New Year in peace and harmony.

Postcard

Some time ago while reading a text, I stumbled across the three letters "KTE", an acronym for Knowledge Transfer and Exchange, which could be particularly pertinent to the context of ISHS activities. Adding the term 'exchange' to the expression 'knowledge transfer' emphasises the two-way relationship between the scientific community and the stakeholders. How can scientists contribute to innovation if they do not recognise their counterparts' needs and expectations? Listening to the requirements of industry can make research more responsive and relevant.

ISHS symposia can offer unique opportunities to listen to what horticulture industry wants, but for this to happen the Society must

be open and welcome stakeholders to get involved. We must invite industry people to participate in our Symposia's organising committees, to chair sessions, to deliver keynote addresses and/or to submit papers. The active participation of other agents in our activities will contribute to make the science we produce more appropriate to its goals and, as a consequence, strengthen and transform ISHS meetings into a fertile culture broth where disciplinary scientists can actively engage and "exchange" with those who use science.

António Monteiro, President of ISHS



ISSUES

A Whole Foods Plant Based Health Perspective, an Opportunity for Horticulture?

Roy McCormick

"There is no connection between food and health. People are fed by the food industry, which pays no attention to health and are healed by the health industry, which pays no attention to food".
Wendell Berry

Sooner or later youthful feelings of non-vulnerability pass by and we can face some challenging personal issues. Chronic illnesses are common where I live and include the likes of heart disease, stroke, obesity, diabetes type II and many forms of cancer. All these chronic conditions can be grouped together under one collective term: 'Diseases of Affluence', because the evidence strongly suggests they are all lifestyle and/or primarily food borne diseases. They do not exist to any extent in less affluent human populations existing largely on a diet of plant based foods (Campbell and Campbell, 2006). Such chronic illnesses are not only a daunting personal challenge for those affected but extremely serious and pressing issues for society at large.

For over seven years I have been adjusting my life to live with coronary artery disease (CAD). This condition results from atherosclerosis, a disease of the vessel wall linings in which fatty deposits or plaques develop. Plaques can slowly grow and block the coronary arteries or, as

is more often the case, form smaller 'unstable' plaques where inflammation processes are active. The thin cellular cap over the plaque can then break open and the plaque contents spill into the blood stream, forming clots to obstruct the blood flow and starve the heart muscle of oxygen. This produces a heart attack, often with fatal consequences.

This short article summarises my learnings over the last seven years from the large body of scientific evidence that supports CAD as a food borne disease but, more importantly, also supports a plant based nutrition as a solution for CAD (Esselstyn, 2001; Ornish et al., 1998). I hope this perspective will be of interest to ISHS society members given that it matches up with the theme of the recently published *Scripta Horticulturae* entitled 'Harvesting the Sun' which profiled the value of horticulture and horticultural plants in the world (McCaffrey, 2012).

As horticulturists and plant researchers we know that plants support life. This is as self evident as it is intuitive and common sense. Look, for example, in our own *Acta Horticulturae* database and read Lohr (2011), who reports significantly improved recovery rates and the need for lower levels of pain control when patients simply had a hospital room with a

tree view compared to those looking out on brick walls. Lohr (2011) mentions some ideas on how these effects can be explained, but the exact mechanisms by which the patient benefits accrue remain unknown. Apart from providing us with food, plants simply have positive effects on humans that we may never fully understand.

The evidence to support a plant based nutrition solution to CAD is extensive and widely published in peer reviewed scientific journals. But unlike Lohr (2011), the mechanisms by which CAD can be prevented and even reversed by plant based nutrition are more fully researched and are discussed below as the main subject of this article. But the majority of the medical establishment completely ignores this body of evidence and this is especially unhelpful for many CAD patients such as myself, who may be open to accept a plant based solution for CAD. Our societies continue to be awash with confused and contradictory messages about food and its relationship to human health. It seems that this is not some form of planned conspiracy, but simply that a constant and continuing state of confusion suits the majority of key players involved in the current culturally dominant health and nutrition paradigm. All the various parties (food producers, medics, government bodies, drug & technology industries, the media

and many patients) simply continue in their daily business of trying to make their living and most are very happy with, and accepting of, the status quo. This is a morally bankrupt and very uneven playing field for those of us who are unfamiliar with the literature and simply want to find the best possible way of dealing with the problem of our clogged arteries.

I do not accept the status quo and I follow a whole foods plant based nutrition to help control my CAD. My reasoning is simply one of risks versus the benefits. If you are unfortunate to have CAD and have survived a major coronary event (heart attack) and have been treated with modern surgery (angioplasty / stents / by-pass surgery) together with drug therapy, but are continuing to eat a standard western diet, then the risk of further cardiac events is very high (Libby, 2005). Libby (2005) in a review paper discusses "The forgotten majority" and it makes for distressing reading; "In the best of circumstances, the decrease in cardiovascular mortality due to statin treatment still allows two thirds of cardiovascular events to occur" (statins are the main group of drugs used to control blood lipoproteins like cholesterol). Atherosclerosis and the CAD processes simply continue largely unchecked even under the commonly recommended diet options, i.e. the Mediterranean diet. Consuming a Mediterranean diet results in a considerable risk reduction of future cardiac events for patients who have had a major coronary event when compared to those who continue with a standard western type diet (de Lorgeril et al., 1999; de Lorgeril and Salen, 2011). However, the disease still progresses and this still leaves a CAD patient with a considerable degree of risk for future cardiac events. Modern CAD treatment purports to treat the disease, but really only treats disease symptoms and leaves the primary cause of CAD largely, if not totally, unaffected.

In 2005 a friend told me about the work of Ornish (1990), who had published a peer reviewed study to demonstrate a non-drug (statins) lifestyle reversal of CAD which included a plant based nutrition and other lifestyle changes such as exercise and social support (Ornish et al., 1998). I changed my food choices to follow Ornish's recommendations of a whole foods plant based 'heart reversal' diet with a small amount of low fat yoghurt (~70 g/d). This plant based nutrition scheme adequately supplied all essential nutrients with the possible exceptions of vitamins D and B12. Vitamin D is usually best provided by sensible sunshine exposure (admittedly difficult at high latitudes for a large part of the year) and B12 is provided by low fat yoghurt or alternatively B12 tablets. Since 2010 I have eliminated all animal foods from my diet and now take B12 tablets. Nevertheless, from 2005 until now I have found a whole foods plant based nutrition perfect and problem free. On a whole foods plant nutrition I have maintained excellent health, I am free from any heart pain and have favourable fasting

blood lipid values (mean of 19 tests over seven years: Total-C=129, HDL-C=38, LDL-C=62 and Trig=107 units as mg/dL), albeit it that I also take some simvastatin medication (20 mg/d). Statin drugs help lower total and LDL cholesterol values, as well as influencing some of the inflammation processes associated with CAD. The target fasting threshold cholesterol values for someone with CAD following a whole foods plant based nutrition are <150 mg/dL for total-C and <80 for LDL-C (<3.88 and <2.07 mmol/L, respectively), see Esselstyn (2007) and the discussion below. There are no target values for HDL and triglycerides but fasting triglycerides should be maintained well under 200 mg/dL. These cholesterol targets are perfectly achievable for the majority of people following a plant based nutrition as described herein (in some cases with or mostly without statin medication). Other workers have clearly demonstrated dietary changes using a portfolio of plant based foods that are all known to reduce blood cholesterol. Results show a portfolio approach can reduce blood lipoprotein values with an efficacy equivalent to the first generation of statin drugs (Jenkins et al., 2005). Taken together, these research results debunk the common myth propagated by many doctors that changes in diet will only influence blood cholesterol values by some 10-15%.

For a CAD patient it is important to clearly distinguish between genes for heart disease and familial patterns, i.e. genetic and environmental effects. The 'Charge Consortium' is a working group currently undertaking massive bio-statistical cohort genetic investigations to try and find possible genetic links for heart disease (Lumley, 2012). While the results are hotly debated, up until now there is no solid evidence to strongly link any variation in human genetics with heart disease. Genetic differences in humans seem rather small and can only explain for example, a 1 mm Hg change in blood pressure which is really very minor. Some genetic evidence exists for a heart disease risk factor but this is located on chromosome nine in a non-coding region of so called junk DNA. Recent research (Barroso, 2012) suggests that non-coding DNA has functional roles in genetic regulation, so we must await further research developments. But there is other strong evidence to rule out a large genetic component in chronic conditions like CAD. Data from migrant studies, where people move for example from Asian countries (low CAD) and maintain the same genetics but make lifestyle changes (primarily diet), shows clearly that CAD soon develops to reach similar levels as in the rest of the western population.

If our DNA fails to explain the majority of variation and patterns in CAD incidence and severity, then this is very helpful news for patients because it means we are not fated to throw ourselves into some trash can for the genetically inferior. It also means that the genetic x environmental interactions are the key to understanding CAD. If the environment can

switch the disease on, then assuming the body is 'plastic' enough, the environment can switch the disease off. There is an increasing weight of evidence (Esselstyn, 2001; Ornish et al., 1998; and others like Jenkins et al., 2007) to support CAD as an environmental food borne disease that can be prevented and even reversed by a whole foods plant based nutrition.

A whole foods plant based nutrition for treating CAD is simply based on consuming whole plant foods (as grains, beans, fruit and vegetables) and excludes any animal foods, any oil products and other highly processed foods like white flour (Esselstyn, 2007). For patients with known CAD, avocados, coconut or other nuts and all fruit juices or smoothies and most processed soya products should be avoided. These nutrition guidelines provide around 10% or less of total energy intake as fat, ~10% as protein and the remaining 70-80% as mostly complex carbohydrate, i.e. primarily starch. Many traditional societies have followed and continue to consume such plant based diets and display very low levels of chronic disease together with low cholesterol values (Total-C generally <150 mg/dL). Campbell, working in rural China, provided what is probably the most astonishing medical statistic of all time. "During 1973-1975 there was not one single person who died of coronary heart disease before the age of sixty-four among 246,000 men in a Guizhou country and 181,000 women in a Sichuan country" (Campbell and Campbell, 2006).

Once a decision is made to follow such a plant based programme, a good recipe book and a supportive partner and/or family situation are required, with the preparation of the majority of meals in your own home. Eating out, while still possible, presents more challenges and requires forward planning. This being said, a whole foods plant based nutrition can easily provide varied, tasty and totally satisfying meals with no negative side effects. Such food choices should not really be termed a 'diet' as energy intake is not restricted, and neither should it be classed as 'vegetarianism' or 'veganism', or any other form of '-ism', because the plant foods have been selected based on determining their physiological effects and disease responses within the human body.

In 2007 a book was published to make arguably the most important contribution to CAD treatment by plant based nutrition, and the discussion that follows below is largely based on it and related resources. Esselstyn (2001, 2007, 2010) tells how he treated and supported a small group of severely affected CAD patients for over 20 years with plant based nutrition. His results are stunning and his conclusion equally stunning: If a CAD patient complies totally with a whole foods plant based nutrition and maintains the target lipid values (as mentioned above), then CAD does not progress and the patient is effectively heart attack proof. The cellular cap over the existing plaques thickens and becomes resistant to rupture. The degree





■ **Fruit and vegetables as whole foods: horticultural products for a plant based nutrition.**

of compliance to the nutrition programme is the key. Take a course of moderation and the atherosclerosis processes simply start up again after every single meal.

One has to compare the results from Esselstyn's patients to the risks of the current conventional surgery and drug treatment options available for CAD that are much higher in terms of further cardiac complications or death. The odds ratio is something like 20-25% or greater risk to 0.5%. The reason for this large difference in outcomes is that plant nutrition treats the cause of CAD while more conventional treatments are focussed on treating disease symptoms.

The current diet recommendations used with conventional treatment regimes, for example the European Heart Network (Anon., 2011), aim for <30% total fat intake (as % of energy) dropping to a longer term goal of 20-25% by using a Mediterranean type of diet. These guidelines allow the processes of food driven atherosclerosis to slow down somewhat but they do not come anywhere near reaching the nutrient levels (i.e. 10% plant fat and 10% plant protein of total energy intake) where the CAD processes can be totally switched off. This difference in treatment outcomes clearly favours a plant based approach and is the reason why I try and take as much control of my own health as I can and comply with a plant based programme.

Atherosclerosis is a disease that develops over a long period of time, driven by diets containing foods that injure the artery walls, allowing blood lipoproteins to penetrate through the endothelium layer (lining of the artery) and to remain lodged in the vessel walls to form plaques. Evidence of plaque formation can now be found in almost everyone at mid-life who is eating a standard toxic western diet. In CAD, the plaque continues to build up in the coro-

nary arteries, inflammation processes can then develop, leading to the plaque cap breaking open and the plaque contents being released to block the artery supplying the heart with blood (oxygen).

How is it then, that plant nutrition is so effective at preventing, and in some cases reversing, the atherosclerosis disease processes? The function of the endothelium plays a major role. The endothelium is a layer of single cells that line the inside of our vessels. It weighs about 1.5 kg and if spread out as a single layer carpet, it would cover a surprisingly large area of 600 m² (Vogel, 1999). The endothelium is also the largest hormone secreting organ in the body and is constantly interacting with the blood stream above it and the vessel layers and muscles below it. When a meal is digested and the contents pass into the blood stream, everything is spread out extremely thinly over this huge surface area of around two tennis courts and minutely sensed by the endothelium. And then the real game of life begins anew after each mealtime as the endothelium reacts to what it senses. This is where our genetics really begin to interact with the environment.

When we eat protective plant based foods (as described above), the endothelium responds by producing nitric oxide (NO). NO is the main substance responsible for dilating our vessels. It has a range of positive physiological effects including vessel dilation, smoother (non-sticky) blood flow, reduced inflammation and reduced plaque formation. Vogel et al. (1997) non-invasively determined endothelial function for the few hours following a high fat meal. He used a research technique called flow mediated brachial artery vascoactivity and followed two groups of students who ate either a high fat or low fat meal at a popular fast food restaurant. The brachial artery tourniquet test places a cuff below

the elbow that is inflated above systolic blood pressure to cut the blood flow in the lower arm for five minutes. On release of the cuff, the brachial artery normally dilates, but when the healthy endothelium function is affected the artery does not dilate, as the endothelium fails to produce enough NO. The changes in arterial diameter can be measured with an ultrasound device. Vogel et al.'s 1997 study was the first to demonstrate that elevated blood triglyceride levels after eating a high fat meal can damage endothelial function. The brachial artery is not the coronary artery, but endothelial function in the two vessels appears to be closely correlated. Foods that injure the vessel linings do not have these positive effects and without enough NO production everything within the vessel becomes 'sticky' and plaque formation is promoted. Injurious foods include all animal foods and processed oils (Rueda-Clausen et al., 2007). Further discussion on oils follows below.

For a long period HDL cholesterol was considered to be protective against atherosclerosis; it has a role in reverse cholesterol transport returning LDL to the liver. But, the relationship between absolute HDL blood values and CAD always had some anomalies. These anomalies now can be explained as HDL function has been shown to be both protective and injurious (Navab et al., 2011). When HDL is damaged by oxidation or inflammation processes, it can injure the arterial wall and increase atherosclerosis. While HDL values from plant based diets are well known to be lower when compared to those of standard western diets, this difference in absolute values does not take into account HDL function. Plant based nutrition will maintain HDL function as both oxidation and inflammation processes are reduced.

Mano et al. (2009) undertook a study with increased consumption of vegetables in Okinawa, Japan, and compared two groups of young healthy women over two weeks who consumed either 356 or 200 g/d of vegetables. Fruit intake was the same in both groups. The higher vegetable intake increased the level of circulating endothelial progenitor cells (EPC) found in the blood. EPCs are produced in the bone marrow and are important to replace worn out endothelial cells or cover bare patches in the vessel walls where cells are missing. CAD patients are known to have lower levels of circulating EPCs. These data support Esselstyn's advice to have vegetables with every meal, every snack, even leafy greens on your breakfast cereal, all with the knowledge that these food choices will increase the level of EPCs, as well as help maintain a positive HDL function and encourage the endothelium to produce NO.

So there are at least four different mechanisms operating by which a whole foods plant nutrition can help prevent atherosclerosis. First, plant nutrition favours much lower blood cholesterol levels (total and LDL) when compared to standard western diets with a large component of animal foods. All animal based foods (meat, fish

& dairy) are well known to raise blood cholesterol values. These effects are not only related to the fact that animal foods are high in fats and cholesterol, but perhaps more importantly, to the protein content of animal foods (Campbell and Campbell, 2006). Furthermore, all three of the above mentioned processes concerning endothelial NO production, HDL function and increased EPCs, are supported by a whole food plant based nutrition. It is important to note that endothelium function and HDL function are not currently directly targeted by any of the standard cardiology surgery or drug treatments. However, this being said, statin drugs are well known to have a range of positive side effects to reduce inflammation processes and affect EPCs, but relying on statins alone to control CAD appears to be a much higher risk option when compared to a whole foods plant based treatment approach.

Whole fruit are very important components of a healthy diet, but fruit also contain the sugar fructose. Fructose can be a problem if fresh fruit consumption is high, for example with fruit juices and smoothies and/or if dried fruit are consumed in excess. A sudden burst of fruit sugar can injure the endothelium and, as may become apparent to anyone with CAD who is also taking regular fasting blood tests, it can also be more difficult to maintain low triglyceride levels. The reason for this fruit triglyceride effect is that fructose is metabolised in glycolysis via the unregulated enzyme fructokinase. Without any entry control into glycolysis, fructose can simply flow through to form triglycerides. If high triglycerides become an issue, then fruit consumption should be restricted to three pieces per day (Esselstyn, 2007).

The oil situation needs some further explanation because there is a common misunderstanding that certain processed plant oils are 'heart friendly'. This is simply incorrect. All of the main plant based advocates, including Campbell, Esselstyn, McDougall and Ornish, are in total agreement on this. One should consider that sufficient fats and all essential double bond fatty acids can be obtained from a whole foods plant nutrition with a total fat content at around 10% or less of total energy intake. Alpha linolenic acid (ALA) obtained from plant sources (e.g. flax, many types of leafy green vegetables) has the necessary double bond chemistry and can be used by the body to build essential fatty acids like DHA and EPA (Sanders, 2009). The literature about essential fats is complex and a fuller discussion is beyond the scope of this article. The conversion of ALA into DHA and EPA is known to be low in individuals following plant based nutrition. However, there is no evidence to suggest that those following a plant based nutrition are in any way unhealthy (Sanders, 2009), and some individuals on a whole foods plant based nutrition regularly consuming flaxseed and leafy green vegetables, can show very high serum omega 3 values (Esselstyn, personal comm. Sept. 2012). Thus, at a base

line level of ~10% fat intake, atherosclerosis is simply switched off and any fat intake above this minimum level, i.e. adding more fat to the system in the form of highly processed foods like oils, regardless of their composition or ratios of unsaturated or saturated fats, will only do one thing: it will turn the atherosclerosis disease processes on again. This is a particularly critical point for patients with known CAD. The confusion over 'healthy oils for the heart' has largely developed from the secondary studies that show very sizable improvements in CAD resulting from a Mediterranean diet when compared to a standard toxic western diet (de Lorgeril and Salen, 2011). However, as stated above, the Mediterranean diet does not switch CAD off completely and while achieving some important improvement, disease incidence and severity can still be considered unnecessarily high and unacceptable given the knowledge that we now have, i.e. very clear evidence that CAD can be completely stopped by plant foods.

CAD patients are seldom presented with a whole foods plant based nutrition treatment option from their medical advisors. The majority of the medical profession are locked into a different treatment paradigm, and even if they are aware of the option of plant based treatment, they believe their patients will not change their lifestyle choices. But to believe patients will not make lifestyle changes is a costly error. Adherence to dietary change is the key issue to obtain plant based health benefits. By economic necessity our current health care systems generally only allow a relatively brief interaction between the patient and the medical care provider. This health care model is not optimal to support lifestyle changes because it simply does not provide enough contact time. Esselstyn has successfully treated over 600 coronary heart patients with a plant based nutrition and achieved very high compliance levels of 90% (Esselstyn, personal comm. Sept. 2012). His heart patients and their primary living partner are given an initial five hour counselling session to examine in detail the disease process and its treatment with plant based food, followed by regular ongoing contact and support via phone and/or email (Esselstyn, 2010).

Other chronic conditions can be positively treated with a whole foods plant based nutrition and the reader is encouraged to read Campbell and Campbell (2006) and McDougall and McDougall (2012). A certificate in plant based nutrition is available from the Campbell Foundation via eCornell. The Campbell Foundation launched this initiative some years ago when it became very clear that any change towards a whole foods plant based nutrition would not occur through existing channels; it will be a 'plant roots' movement. A whole foods plant based nutrition is an exciting opportunity for horticulture to support human health.

ABBREVIATIONS

CAD: coronary artery disease
 Total-C: total cholesterol
 LDL-C: low density lipoprotein, so called bad cholesterol
 HDL-C: high density lipoprotein, so called good cholesterol
 Trig: triglycerides
 EPC: endothelial progenitor cells
 NO: nitric oxide
 ALA: alpha linolenic acid, an omega 3 fatty acid obtained from plants
 DHA: docosahexanoic acid, an essential omega 3 fatty acid made in the body from ALA
 EPA: eicosapentaenoic acid, an essential omega 3 fatty acid made in the body from ALA

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THE WORLD OF HORTICULTURE

Urban Horticulture and Green Open Space

David E. Aldous and Margaret Johnston

If one reads the works of Steve Kellert's and Edward Wilson's "The Biophilia Hypothesis" (1993), Charles Lewis' "Green Nature/Human Nature" (1996), Rachel and Steven Kaplan's "Humanscape: Environments for People" (2002), Howard Frumkin's (2003) "Healthy Places: Exploring the Evidence" or Richard Louv's "Last Child in the Woods" (2005), you come to realize that plants and horticulture are not just about food and nutrition, but they can also fundamentally contribute to improving the quality of the world's environment, economy, society and health in realizing the healthy relationship we have with nature. More formally called environmental horticulture, the sector has been termed amenity horticulture, and more lately, urban or lifestyle horticulture.

The late Michael Mullins, Australia's first Professor of Horticulture at the University of Sydney, defined environmental horticulture "as being concerned with plants and the enrich-

ment of the built or man-made environment... embraces ornamental plants, gardening, landscape design and reclamation of degraded landscapes, and includes the scientific, technical and aesthetic aspects of amenity plantings of all types including those whose function is recreation" (Mullins, 1978). A year later Professor Richard Rowe, of Lincoln University in New Zealand, described the amenity horticulture industries "as those people and organisations who are engaged in the production, sale and management of plants used for environmental, recreational and leisure purposes". Today the urban horticulture industry comprises "those businesses involved in the production of non-food horticulture products and planting stock for the fruit, vegetable and forest industries including ornamental, fruit and forestry plants, cut flowers and foliage, and turf grass and the delivery of a range of services using the above products such as landscape design, contract-



ing and maintenance (including arboriculture) services, wholesale and retail sales of urban horticulture products and services, parks, gardens, golf courses and indoor plant establishment and maintenance; and the technical horticultural advice, information dissemination and project management" (Australian Centre for Lifestyle Horticulture, 2012).

Figure 1. Increasing amounts of food, fibre and medicinal plants are coming from community gardens located in urban/peri-urban areas.



functions, has long been considered a community's natural life support system (Benedict and McMahon, 2002). Urban parks, gardens, trees, turf grass, golf courses, sports fields, lawn cemeteries, school and university landscapes, and community and roof gardens, are among the many assets that perform important ecological services that benefit both humankind as well as the natural world. The benefits can be best observed within six different spheres – food and fibre production, aesthetics, environment, social and cultural, public health, and the economy.

FOOD, FIBRE AND MEDICINAL BENEFITS

With increasing numbers of a country's population migrating to urban and peri-urban areas, particularly in the heavily populated areas of China, Africa and Latin America, there has been an increasing demand to grow quality nutritious food within the city's boundaries. These green areas are increasingly contributing to a country's economy in the form of income and employment in food and fibre, as well as providing for medicine, compost and alternative energy sources. A number of countries could well reduce their reliance on food imports by using aeroponic (growing plants without soil and water but with a periodic spraying of the root system), aquaponic (growing plants using recycled fish waste), and hydroponic (growing plants using mineral nutrient solutions, in water, without soil) techniques, as well as making greater use of community, wall and roof top gardens (Fig. 1).

AESTHETIC AND VISUAL BENEFITS

As part of any city's green landscape, plant materials not only provide for stability and function, but can also enhance nature's beauty, through their different forms, colours and tex-

In 2008 Haydu and co-workers estimated that the global urban horticulture market for North America, Latin America, Europe, the former Soviet Union, Asia and Oceania, the Middle East and Africa was worth about US\$287.5 billion or approximately 1% of the US Gross Domestic Product. Hall and Hodges (2011) described the US lifestyle horticulture market as having a total employment impact of \$US1,949,635, made up from the production and manufacturing, horticultural services, and the wholesale and retail trade sectors. Such green economies have become significant in recent years because of the important effect that they have on the natural environment and biodiversity, waste and recycling, adapting to and mitigating cli-

mate change, and the provision of sustainable products, businesses and services.

GREEN BENEFITS OF THE LIFESTYLE HORTICULTURE MARKET

In recent years a range of national and international researchers have published widely on the benefits that the urban horticulture industry provides to the individual as well as the wider community. The benefits of green infrastructure, which has been described as an interconnected system of green spaces that conserve natural ecosystem values and

Figure 2. Trees provide shade and turf coolness, all in a friendly social atmosphere.



Figure 3. People socializing in urban green open space.



tures. They also contribute to improving mood and psychological health as well as enhancing psychological wellbeing.

ENVIRONMENTAL AND ECOLOGICAL SYSTEMS BENEFITS

Living green open space can moderate climate (Finnigan et al., 1994; Nowak et al., 2002; Aldous and Power, 2007; Aldous and Holborn, 2012), provide shade, improve air quality, collect and filter storm water, reduce air and water pollution (Falkner, 2003), prevent soil erosion and stabilize dust particles, play a part in nutrient recycling, and improve the safety of vehicles on roadsides (Beard and Green, 1994; Higginson and McMaugh, 2010) (Fig. 2). Green open space can also contribute to the conservation, protection, shelter and restoration of biodiversity on our planet (Trees for Cities, 2011).

SOCIAL AND CULTURAL BENEFITS

Green open space has been shown to provide considerable social capital in terms of employment, education and recreational benefits, providing for safe recreational use (Patel, 1992) and a sense of social place, enhancing feelings of family kinship and solidarity, and promoting spiritual growth (Dunnnett and Qasim, 2000) (Fig. 3). Other social benefits have included reducing personal and neighborhood problems (Lewis, 1996), reducing domestic violence, vandalism and crime by building interpersonal relationships with at-risk juveniles (Kuo and Sullivan, 2001a,b). Working with plants has also provided significant opportunities for people with disabilities to become part of the community by being able to meet new friends, develop new skills, as well as provide routine from their institutional environment.

Figure 4. Walking and hiking in bushland – a great physical exercise to do with urban green open space.



HUMAN HEALTH, WELLBEING, AND SPIRITUAL BENEFITS

Physical activity, such as walking or cycling to work, or being directly involved with natural green space activities, such as gardening, nursery work or the growing of plants, has been shown to alleviate stress and reduce mental fatigue (Pretty et al., 2005; Kuo, 2010) (Fig. 4), increase wellbeing and self-esteem (Smith and Aldous, 1994), reduce the potential for anger (Ulrich and Parsons, 1992) and the risk of dementia (Simon et al., 2006), aid in a more rapid recovery and reduce time spent in a hospital setting (Ulrich, 1984). Maller and co-workers (2002, 2006) found that patients working in a natural environment experienced improved health, visited their general practitioner less often, took fewer prescription drugs, felt safer in their community, experienced less pain and

discomfort, and had more opportunities to use their skills, when compared with patients returning to their normal setting. McKenna's (2003) study from Newcastle-on-Tyne in the UK indicated that organised walks and physical activity programs, when referred by their doctors, could provide the necessary physical exercise to reduce health costs as well as improve the general health of the individual (Wang, 1999) (Figs. 5 and 6). The following have put pen to prose in expressing the worthiness of gardens and gardening:

"Half the interest of a garden is the constant exercise of the imagination. You are always living three, or indeed six months hence. I believe that people entirely devoid of imagination never can be really good gardeners. To be content with the present, and not striving about the future, is fatal" Alice Morse Earle (1897).

"The man who has planted a garden feels that he has done something for the good of the world" Charles Dudley Warner (1870).

ECONOMIC BENEFITS

Green open space has long contributed to a country's economy in the form of income and employment (timber, food, fibre), as well as providing for medicine, compost and energy. Urban green open space benefits can be both direct and indirect. Direct economic benefits have been associated with a region's economic stability in the way of attracting receipts and employment (Hall et al., 2006; Hall and Hodges, 2011), and promoting investment, increasing property values, and boosting business and tourism opportunities (Aldous, 2007), such as the recent World Horticultural Expo Floriade (Fig. 7), the RHS Chelsea Flower Show, the Melbourne International Flower and Garden Show and many other exhibitions and sports events that promote and communicate hor-

Figure 5. Grassed sports areas provide for both passive and active recreation.



Figure 6. Children enjoying play in urban green open space.





Figure 7. Floriade 2012, the Netherlands' World Horticultural Expo takes place every 10 years.

gricultural excellence. The economic impact of natural areas and green open space can often extend beyond any local property tax income. The Saskatchewan River Valley Alliance (2007), in Canada, spent \$1.2 billion (\$AUD1.2 billion) on its nature-related activities, including \$171.6 million (\$AUD170.9 million) on wildlife viewing, \$147.8 million (\$AUD147.2 million) on fishing, and \$71 million (\$AUD70.7 million) on hunting. In addition these nature-related activities supported 23,600 jobs and provided the local and Alberta provincial government with \$369 million (\$AUD367.3 million) in tax revenue. Within the parkland of the Asian City of Chandigarh, India, Chaudhry (2008) found that the annual value of recreational use of parks/gardens, boulevards, green avenues, reserve forests, wild life sanctuaries and other landscape features, was in the order of Rs. 120.00 million (\$AUD279.0 million), Rs. 27.50 million (\$AUD 64.0 million) from residential business, and Rs. 92.40 million (\$AUD214.0 million) from tourism activities. Indirect economic benefits are often associated with increased energy efficiency and decreased energy demands in air conditioning costs, with vegetation contributing to lowered local air temperatures by transpiring water and shading surfaces. Natural green open spaces have been shown to indirectly reduce health costs associated with obesity, physical inactivity, diet and sporting injuries. Green space in the United Kingdom is worth at least £30 billion a year in health and welfare to its citizens (The Guardian, 2011).

GREEN LIFESTYLE BENEFITS IN AUSTRALIA AND SINGAPORE

In recent years three significant features have influenced the extent, distribution and value

of lifestyle horticulture products and services in urban and peri-urban communities. Last year more than half of the world's population lived in cities, or in areas surrounding those cities (peri-urban areas) and this trend is likely to continue into the future. Increasing city populations place pressure on the available energy sources, the non-renewable natural resources, as well as the carrying capacity of these urban green open spaces. Cities that have shown success in green open space management are Singapore with an area of 625 km², a population of 5 million people and some 7.5 m² per capita green space (Conserving our Diversity, 2009), and Australia, with a population of 22.6 million people and on average 16.3 m² per capita green space (Brack, 2002). Singapore's strategic vision has transformed the design of its city from a "garden city" to a "city in a garden" (National Parks Board, 2012). In Singapore the recently opened 54 hectare Gardens by the Bay project includes groves of super trees that rise

in height from 25 to 48 m and serve as vertical gardens that contain orchids, bromeliads, vines and ferns. A 120 m elevated walkway connects the two tallest super trees, all of which light up during the evening to extend the hours of the park (Fig. 8).

With 85% of the population living within 50 km of the coastline, Australia is fortunate in having many people living in cities, towns and suburbs that have adequate space to allow for ornamental plants and trees, fruit trees and vegetables to be grown (Ghosh and Head, 2009). However, the recent trend has been to smaller land areas in the newer suburbs and this has increased the need for higher quality urban spaces (Francis et al., 2012) and greater strategic thinking when it comes to urban/lifestyle horticulture design and planning. In Queensland, we have seen the development of the Roma Street Parklands, 16 hectares in the state's capital city Brisbane, which opened in 2001, and the Perth Waterfront, a \$AUD440 million development currently under construction, which is expected to bring in 4 million people to the precinct each year (Trenwith, 2012). Both of these are examples of tourism and public benefit in urban/lifestyle horticulture. The recent CBD greening of Sydney and Melbourne, the capital cities of NSW and Victoria respectively, have also made these areas more attractive to workers, residents and visitors (Cummins, 2012).

CONCLUSIONS

Green open spaces and the associated urban/lifestyle horticulture products and services benefit many countries by providing nutritious food sources as well as resources that will improve the quality of lives and lifestyle. The increasing population density of our cities, and the impact of climate change, have made councils and government departments more aware of urban horticulture principles and practices and the need to maintain higher quality green open space.

Figure 8. Singapore's super trees on display during the day and evening.



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Sustainability of Intensive Vegetable Farming in the Up-Country Region of Sri Lanka: A Situation Assessment

L.D.B. Suriyagoda, R.H.G. Ranil, D.M.S.B. Dissanayaka and W.A.P. Weerakkody

INTRODUCTION

The central highland of Sri Lanka (6°6'N, 80°5'E, 1500 m a.m.s.l. and annual rainfall >2500 ml) is famous for intensive cultivation of exotic vegetables (Fig. 1). There are about 60,000 ha devoted to vegetable production on steep slopes with heavy application of agro-chemicals, and 3-4 crop cycles per year without a fallow period (Deb, 1992; Wijewardena, 2001) (Fig. 2). The main vegetable crops cultivated in the open field conditions are bean, beetroot, cabbage, carrot, knolkhol (kohlrabi, *Brassica oleracea Gongylodes* group), leek, radish and tomato. The majority (60%) of greenhouse growers in the country is located in this region and the area under greenhouse cultivation is rapidly expanding (Niranjan et al., 2005). The vegetable crops grown under protected cultivation are tomato, bell pepper, cucumber and some exotic leafy vegetables, targeting the demand from high-value mar-

Figure 1. Map of Sri Lanka showing the up-country where most of the vegetables are grown.

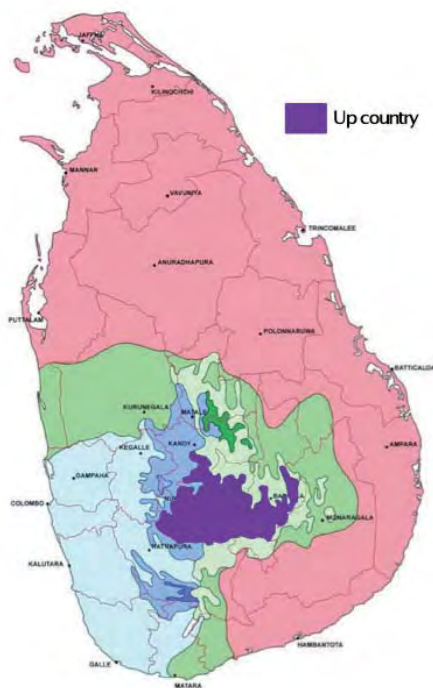


Figure 2. Intensive cultivation of vegetable crops on sloping land in up-country neighboring native forests (Photographs by K.S. Hemachandra).



kets. Vegetables produced in the open field are marketed through the conventional wholesale marketing system (Weerakkody, 2004). The up-country vegetable cultivation system plays a crucial role in both the economy and the food chain in Sri Lanka, providing fresh vegetables all over the country throughout the year. Meanwhile, a significant proportion of vegetables such as tomato, leek, carrot and bean produced in this area is exported (FAOSTAT, 2004; Central Bank of Sri Lanka, 2008).

Up-country farmers are full-time vegetable producers. However, their profit is decreasing as the costs of production are increasing. Therefore, farmers tend to safeguard their crop income by intensifying agronomic practices mainly through overdosing agro-chemicals. The Department of Agriculture has noted that the present up-country vegetable sector is producing only 82% of the expected yield of crops. However, the contribution of the up-country vegetable production system to the Sri Lankan agricultural sector and economy is immense, despite the numerous drawbacks associated with it. The most significant downside of this vegetable cropping system is the over-use of agro-chemicals. Others include encroachment into natural ecosystems, deforestation, soil and land degradation, soil erosion and environmental pollution (Illeperuma, 2000). Some authors believe that "the up-country intensive vegetable farming system is one of the serious environmental catastrophes in the country" (Illeperuma, 2000; Jayasinghe et al., 2011). It is a real challenge for agronomists, environmentalists and policy makers today to find avenues for overcoming this situation and bringing about sustainability in up-country vegetable farming in terms of utilization of natural resources and technical inputs. This paper aims to assess the present status of the up-country vegetable cultivation system and its impact on the environment.

PRESENT STATUS OF UP-COUNTRY VEGETABLE PRODUCTION

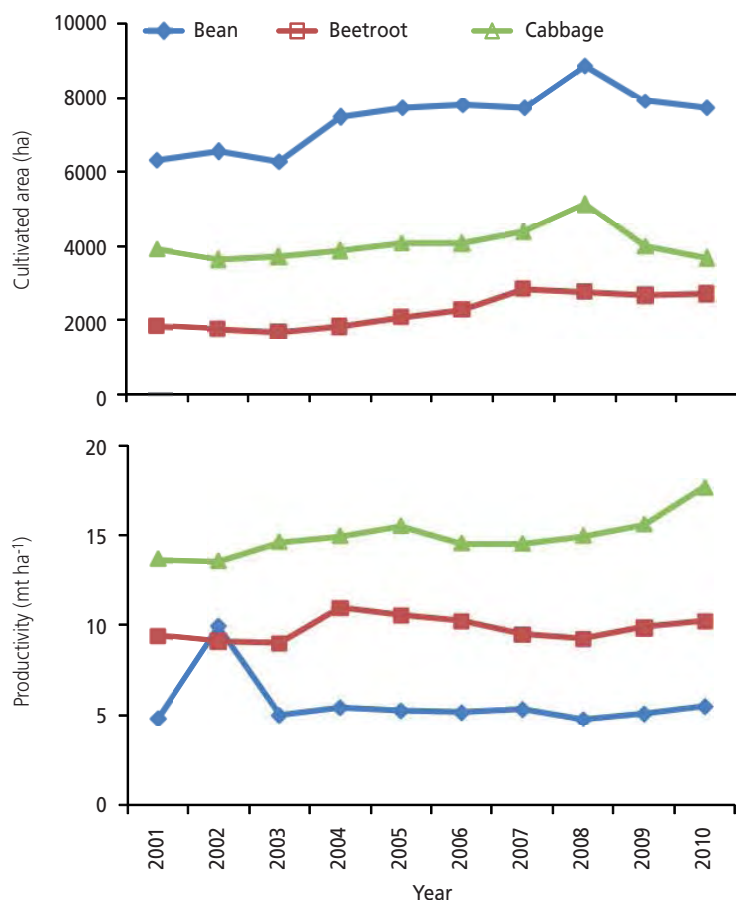
The extent and productivity of major vegetable crops grown in the region for the last ten years are shown in Figure 3. For all crops, production area and productivity over the years have remained relatively stable owing to continuous intensive management of the system (i.e. soil fertility, pest and disease management, etc.) aiming for higher profits.

STATUS OF SOIL FERTILITY

The soils of the region are Ultisols formed from highland series rocks. This soil class is characterized by its low concentration of phosphorus, organic matter and exchangeable bases,



Figure 3. Cultivated area and productivity of selected vegetables growing in the up-country from 2001 to 2010. Note: production area for tomato is similar to that of bean, and areas for carrot, knolkhol, leek and radish are similar to that of beetroot. Source: AgStat (2001-2010).



by its fairly acidic reaction and a fair content of potassium (Wijewardena, 2000 and references therein). Considering that most vegetables have a short growth cycle (i.e. mostly 2-4 months), are fast growing and require a small volume of soil, it is essential that nutrients be applied and be available directly within the root zone for optimal growth. Unfortunately, in order to satisfy this demand, the level of fertiliser applied by the farmers to their crops is almost two to three times the quantity recommended by the country's Department of Agriculture. Since the net return from vegetable cultivation is much higher than that from rice and other field crops, the use of synthetic fertiliser is economically feasible and cost-effective. The private sector dominates the fertiliser market, and provides attractive packages such as easy-pay deals and transportation to farm gates (Hettige and Senanayake, 1992). Availing themselves of the easy supply, most farmers think only to use various types of granular and liquid fertiliser, unaware of the alternatives.

The Department of Agriculture has recommended the application of organic manures

(in particular, poultry and cattle manure) to maximise fertiliser-use efficiency while reducing the rates of application of inorganic fertilisers. This practice is believed to improve the soil chemistry (e.g. pH and EC), and physical (e.g. texture) and biological properties (e.g. soil flora and fauna) to a favourable range for optimal growth of crops. Thus, it is assumed that the use of poultry manure could result in higher crop yields in continuous cropping. In general, quantities added range from 10 to 15 t ha⁻¹ yr⁻¹ of poultry manure and from 20 to 30 t ha⁻¹ yr⁻¹ of cattle manure (Wijewardena, 2000 and references therein). With the application of higher quantities of organic matter over a long period of time, the accumulation of nutrients (e.g. N, P, K, Ca and Mg), and the occurrence of nutrient imbalances were also observed in this system. Moreover, such overdoses of both inorganic fertiliser and organic manure caused soil degradation, environmental pollution, increasing cost of production, disease susceptibility and low produce quality (Wijewardena and Amarasiri, 1990; NARESA, 1991; Deb, 1992; Jayakody, 2002).

USE AND MISUSE OF AGROCHEMICALS

Vegetable growers in the up-country rely heavily on agrochemicals, particularly insecticides, fungicides and synthetic fertilisers. Overdosage of agro-chemicals is the normal practice and causes numerous problems. Premarathne et al. (2010) reported elevated concentrations of Cd, Cu, Ni, Pb and Zn in the surface horizons of 40 soils from this region in Sri Lanka, with some soils exceeding the safety limits for Cd. Moreover, heavy metal concentrations in soils were significantly correlated with number of years under cultivation. Even though the exact source of these chemicals is not known, many scientists believe that the accumulation is due to the continuous addition of external inputs over a long period of time.

Herbicide use in up-country vegetable farming is scarce because of very short fallow periods, and because most weeding is done by hand by the small farm holders (less than 0.5 ha in most instances). However, fungicides and insecticides are extensively used. Applications are very frequent, with higher concentrations, volumes and frequencies than recommended (Hettige and Senanayake, 1992; Sumith, 2002). Consequently, there are numerous adverse effects on human health, the environment and agriculture itself.

Weaknesses in advisory services and propaganda campaigns by large pesticide companies are the main reasons for heavy reliance and dependency on agro-chemicals by vegetable growers. Farmers believe that the use of these modern chemicals is the only solution for minimising risks associated with pest and disease outbreaks. The low investment capacity of farmers, which drives them to credit-deals, is another reason for them to be over-dependent on agro-chemical dealers and their sale-oriented advisory services (Hettige and Senanayake, 1992).

Public concern over insecticide and fungicide residues in vegetables has been increasing over the past years. Products are regularly screened for possible residual effects, but because of unsound practices such as applying overdoses, too frequent applications, harvesting before the recommended withholding period, and even application after harvest (as a commodity treatment during post-harvest handling) high residue levels are found in foods (Sumith, 2002). Therefore, rigorous testing of crop management, and especially of pesticides used on vegetables available on the market, are vital to safeguard the consumer from chronic poisoning due to agro-chemical residues. There have been no comprehensive studies conducted in the recent past assessing the residue levels in vegetables in Sri Lanka (Sumith, 2002). Although organochlorine insecticides such as aldrin, dichlorodiphenyltrichloroethane (DDT), dieldrin, endrin, hexachlorocyclohexane (HCH),

heptachlor, and lindane have been phased-out of use in Sri Lanka for three decades, their residues still remain in the environment. A study conducted by the Registrar of Pesticides on several vegetable samples collected from the retail market confirmed the presence of residues such as organophosphates, carbamates, and organochlorines above the safety levels. Unfortunately, continuous monitoring of residue levels is not taking place in the country, due to the lack of required laboratory facilities (Sumith, 2001). Regulatory authorities have the necessary mandates for the establishment of Maximum Residue Limits (MRL) for crops with respect to pesticides registered in the country, and the government of Sri Lanka can enforce recommendations. This would enable farmers to determine the Pre-Harvest Intervals (PHI) for pesticides, thus maintaining residues below the MRLs. These vital parameters must be developed under local conditions as the fate of pesticides is greatly dependent on local environmental conditions, crop management and feeding habits.

IMPACT ON NATURAL ECOSYSTEMS

The up-country has been identified and designated as a biologically significant and hydrologically important area in the country (Werner, 1982; Wijesundara, 1991; Balasubramaniam et al., 1993; IUCN, 2007). Up-country natural ecosystems are composed of montane forests, sub-montane forests, grasslands, natural water bodies, etc., which provide unique habitats for a diverse flora and fauna including endemic, threatened and rare species (IUCN, 2007). For example, 24% of the Nuwara-eliya district (1720 km²) consists of natural forest cover and it provides habitats for over 150 threatened plant species and 84 animal species (IUCN, 2007).

Even though vegetables were cultivated without much disturbance to the natural balance of ecosystems in the past, things have changed dramatically as vegetable production has become a highly commercial and economically important venture today. Humans have jeopardized the natural balance of this

ecosystem. The negative impact of up-country vegetable farming on natural ecosystems is a clear example of such a disturbance.

The encroachment into natural forests by agricultural activities is also becoming a serious environmental issue in up-country areas. There are many newspaper articles describing the severity of forest encroachments by the up-country vegetable cultivation. This encroachment even extends to the Hakgala nature reserve, with the blessing of politically powerful lobbies and condescending authorities. Initially such encroachment activities affect the hydrological cycle in that particular area. On a longer time scale, these haphazard agricultural activities affect the ecology and reproductive biology of both flora and fauna in adjacent areas. Up-country montane forests not only directly contribute to rainfall, but also intercept fog, which accounts for almost half of the total precipitation during dry months, and increase in tree cover could positively contribute to the water yield in the catchments in addition to its protective role in the environment. Therefore, conservation of natural forests in the up-country area should be a top priority.

IMPACT ON WATER BODIES

Unsustainable agricultural practices are the main determinants for water pollution in up-country areas (Jayasinghe et al., 2011). It has been estimated that erosion rates from smallholder mixed vegetable farming in the Uma Oya catchment, range between 100-280 t soil ha⁻¹ yr⁻¹ when compared with just 0.3 t soil ha⁻¹ yr⁻¹ for dense forests in the Nuwara-eliya district (EFL, 2005). Concurrently, severe soil loss, around 15 t soil ha⁻¹ yr⁻¹, has been reported in areas cultivated with vegetables and/or potato. Therefore, farming activities in the up-country region have increased the sedimentation and changed the quality and quantity of water in waterways.

Due to the hilly nature and high rainfall in the area, applied agrochemicals can be washed out easily and the accumulation of these compounds has a serious impact on

aquatic biodiversity and human health. Several reservoirs, streams and wells in the region are already affected. When considering reservoir contamination, excessive fertiliser application has caused eutrophication in natural and manmade water bodies in the Nuwara-eliya area. As an example, Amarawansa and Indraratne (2010) found that intensively cultivated soils in Nuwara-eliya exhibit very high concentrations of available P in the surface layer, posing negative impacts on water quality. Illeperuma (1998) has studied water quality of Gregory Lake and Barrack's Plain Reservoir in Nuwara-eliya district and found that the dissolved oxygen concentration in the latter was very low, endangering fish populations (Table 1). Jayasinghe et al. (2011) recently found that Bomuruella Reservoir in Nuwara-eliya, a main drinking water source, was also polluted with the discharge of agricultural runoff. When considering the quality of drinking water, NO₃-N concentration has increased over the safety level of 12 mg kg⁻¹ in the drinking water in the Pattipola area and Mn was detected in traces in wells in the catena (Jayakody, 2002). In addition, such water bodies are highly polluted with heavy metals such as Cd, Pb and Zn.

In order to protect natural forests, waterways and up-country vegetable cultivation, it is important to take necessary initiatives and actions carefully (i.e. both short and long term) by conducting comprehensive research, changing land use policies, implementing these policies by educating the stakeholder groups (i.e. general public), providing proper guidelines for the use of agrochemicals and strengthening the rules and regulations governing their usage. If the majority in the community understand and abide by the roadmap, it will be possible to turn the current unsustainable practice into a sustainable venture in the near future.

CONCLUDING REMARKS

The up-country of Sri Lanka is famous for intensive cultivation of exotic vegetables and its contribution to Sri Lankan agriculture. Even though the up-country vegetable production system has to be continued and further improved to meet the steady market demand, its long-term sustainability is at stake. Improper handling of agrochemicals is of major concern, as it negatively impacts on the environment and human health. Moreover, encroachment into natural ecosystems, deforestation, soil and land degradation, soil erosion, and pollution of freshwater, soil and air have threatened the existence of endangered species, and the balance of natural ecosystems. These threats to the ecosystem of the up-country justify a reassessment of the intensive vegetable cultivation practices from all concerned parties to ensure its sustainability.

Table 1. Water quality of selected water bodies in the up-country region.

Water body	DO (mg L ⁻¹)	COD (mg L ⁻¹)	BOD (mg L ⁻¹)	Coliform per 100 ml	Total-N (mg L ⁻¹)	Total-P (mg L ⁻¹)
Lake Gregory	7.0-9.0	24-44	30-50	70-230	23-48	0.2-0.8
Barracks Plain Reservoir	0-0.3	30-250	12-30	>1000	30-50	1.4-1.8
Mahaweli River	7.0-7.5	8-10	3.5-4.7	2200	5-10	0.5-1.0
Sri Lankan standards for drinking water	4	30	5	<5000	15	2

DO: dissolved oxygen, COD: chemical oxygen demand, BOD: biochemical oxygen demand. Source: Illeperuma (1998).



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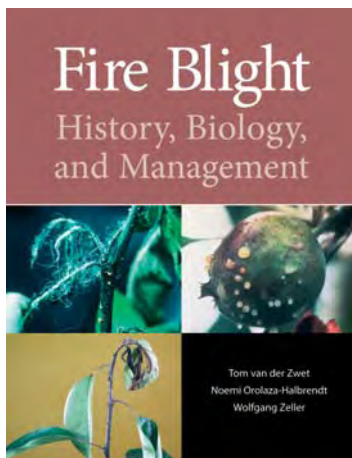


New Books, Websites

BOOK REVIEWS

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

Fire Blight: History, Biology, and Management. Tom van der Zwet, Noemi Orolaza-Halbrendt, and Wolfgang Zeller. 2012. APS Press, St. Paul, MN, USA. 460p. ISBN 978-0-89054-394-8 (hardcover). \$299. www.shopapspress.org



The 'Fire Blight Bible' was a labour of love written by Tom van der Zwet and his colleagues. This publication has come approximately three decades after "Fire Blight: A Bacterial Disease of Rosaceous Plants" that has been referred to by so many working on the disease since 1979. Fire blight, caused by *Erwinia amylovora*, is an economically important bacterial disease of pome fruit and, as such, has attracted much attention from research scientists over many years. It has even been the cause of two World Trade Organisation disputes between nations trading apples.

This new publication includes 20 extremely informative chapters on the disease. The 3 chapters in Part I are devoted to history – Early Theories and Discoveries Regarding Fire Blight; Spread and Current Distribution of Fire Blight; and Losses Due to Fire Blight and Economic Importance of the Disease. In Part II, the biology of fire blight is detailed in 8 chapters, with extensive sections on The Disease – symptomatology of fire blight and host range of the pathogen; The Pathogen – taxonomy, detection, and identification, growth and physiology, and genetic diversity; Host-Pathogen Interactions – physiology and biochemistry of fire blight infection, and pathogenicity and virulence factors of the pathogen; and Epidemiology – the disease cycle of fire blight, and the effects of host con-

ditions, cultural practices, and environment on disease development. Part III contains 9 chapters on management with discussion on Enhancing Host Resistance – breeding, utilizing host resistance, and chemical and cultural approaches to enhance host resistance; Reducing Inoculum Levels – exclusion of fire blight by sanitation, eradication, and quarantine, and reducing inoculum levels in previously infected orchards; and Interfering with the Infection Process – fire blight risk assessment and prediction models, chemical agents that interfere with infection, biological control, and integrated management strategies. The 121 color plates provide an excellent reference to symptoms of the disease on a number of different rosaceous plants, a guide to the identification of the pathogen on culture media, and inoculation techniques used by researchers. Finally, there are a number of useful appendices on phyto-bacteriological and molecular biology techniques; theses and dissertations on fire blight; books, chapters, reviews, bulletins, and feature articles on fire blight; and a list of American and international workshops on fire blight that have been held worldwide.

This latest publication summarises international knowledge of fire blight and it is a 'must have' for both scientists new to the field, and those who have been associated with research on the disease over many years. It will act as a valuable resource for everyone in the pome fruit industry, and the authors are to be congratulated on the production of such a comprehensive account of the history, biology, and management of the fire blight disease.

Reviewed by Chris Hale, Chair of ISHS Commission Plant Protection

Gartenkultur in Russland. Anna Ananieva, Gert Gröning and Alexandra Veselova (eds.). 2012. International Symposium, 9-11 May, 2012, Zentrum für Gartenkunst und Landschaftsarchitektur (CGL), Leibniz Universität, Hannover, Germany. 119p.

Within the German-Russian Year of Science an international and interdisciplinary symposium took place at the Centre for Garden Art and Landscape Architecture at Leibniz University Hannover in May, 2012. It was supported by the Conference of University Presidents, the German Federal Ministry for Education and Research, the Leibniz University Hannover and the Centre for Garden Art and Landscape Architecture (CGL). The topic of the symposium was "Garden Culture in Russia". From several perspectives this topic must be regarded as highly desirable. In Germany for example,



there are only a few scholarly publications about garden culture in Russia. Also, in Russia itself there is a lack of research in this field. Apart from a few meritorious studies, the long-term transfer of garden culture between Germany and Russia has been neglected. Now, for the first time scholars from Russia, Denmark, the United Kingdom, and Germany met to exchange results of their research about garden culture in Russia.

In their introduction to the book "Gartenkultur in Russland" (Garden Culture in Russia), Anna Ananieva, Gert Gröning, and Alexandra Veselova explain the topic and the structure of the symposium.

The first section of the symposium was dedicated to the "Garden and its Everyday Life". Linguist Valeria Kolosova (St. Petersburg) looked at the meaning of gardens and flowers in songs and rituals of various Slavic people. Art historian Marcus Köhler (Neubrandenburg) demonstrated how late eighteenth-century landscape gardens reflected the Russian national style. Literature scholar Ekaterina Dmitrieva (Moscow) researched country estates as carriers of the mythological Golden Era, and literature scholar Sigrid Thielking (Hannover) looked at the Russian country estate summer as a literary way of life. Conservationist Andrej Rejman (St. Petersburg) presented the development of the Aničkov Palace gardens in St. Petersburg from the eighteenth to the twenty-first centuries. Historian Katharina Kucher (Tübingen) addressed Gorki-Park in Moscow (1928-1941) as the socialist garden prototype. Art historian Boris Sokolov (Moscow) dedicated his presentation to mutual influences between garden art, literature, painting, (interior) architecture, and the art of sculpture around 1900.

In the second section "Gardens and other Arts", ethnologist Alexandra Ippolitova (Moscow) had a closer look at landscape representations in a



late eighteenth-century herbal. Garden scholar Gröning selected the example of the park at Shablykino, gouvernement Orel, to indicate lines along which a continuing Russian-German dialogue can enhance garden culture knowledge. Literary scholar Klara Šarafadina (St. Petersburg) presented her research about the garden motif in classical nineteenth-century Russian literature. Landscape architect Joachim Schnitter (Hamburg) claimed relations between the use of garden motifs and the writer biographies of Vladimir Nabokov and Anton Čekhov.

Theater and literary scholar Olga Kupcova (Moscow) took theater-games in the gardens and parks of Russian country estates around 1800 as her research topic. Art historian Irina Paščinskaja (Peterhof) showed how early nineteenth-century garden and park illuminations in Peterhof served to demonstrate and legitimize imperial power. Musicologist Christoph Flamm (Berlin) delivered a meaningful contribution to the interaction between garden space and music creation exemplified by the music played in the gardens of eighteenth-century St. Petersburg summer residences. Garden culture and music were additionally addressed at this symposium in an evening performance. Musicians Ulla Bunies and Assen Boyadjev played sonatas from the almost forgotten composer and violin virtuoso Anton Ferdinand Titz (+1810, St. Petersburg).

The third and last section of the symposium addressed "Gardens and its People". Literary scholar Veselova highlighted fruitful international cooperation between garden scholars.

Her research indicated how garden-art-related categories developed around 1800 in Russia as a consequence of trans-national knowledge transfer. This included the reception in Russia of Hirschfeld's five volume "Theorie der Gartenkunst" (Theory of Garden Art) (1779-1785). In her contribution, art historian Margrethe Floryan (Copenhagen) was especially concerned with the Hirschfeld reception by the Russian writer and country estate owner Andrey Timofeevic Bolotov (1738-1838). Some of the works of Georg Kuphaldt (1853-1938), one of the most important German landscape architects in the Czarist empire, were reported by architecture historian Irina Naščokina (Moscow). Still today Kuphaldt's creations epitomize the cityscape of Riga, the capital of Latvia. Lack of maintenance turned the once imperial park at Petrodvorec (Peterhof) into a city forest as literary scholar Stanislav Savickij (St. Petersburg) showed in his analysis of Lidija Ginzburg's novel "A Circle Circumscribing Thought", which he read as an example for reflection about ethnic guidelines. Literary scholar Andreas Schönle (London) concluded the symposium with his thoughts about Russian gardens as manifestations of political struggle and their contribution to modernity.

It is highly desirable that this first symposium on garden culture in Russia be followed by many more in order to gradually reduce the still huge research deficits in this vast field.

The bi-lingual publication (Russian and German) with abstracts, short cvs, and photographs is available at the Centre for Garden Art and

Landscape Architecture (CGL), Leibniz University Hannover, Herrenhäuser Strasse 8, 30419 Hannover, Germany.

A volume with the collected contributions edited by Ananieva, Gröning, and Veselova is scheduled for 2013.

Reviewed by Johanna Söhnigen, Berlin, Germany

NEW TITLES

Schweizer, Stefan and Winter, Sascha (eds.). 2012. Gartenkunst in Deutschland. Von der Frühen Neuzeit bis zur Gegenwart. Verlag Schnell & Steiner, Regensburg, Germany. 576p. ISBN 978-3-7954-2605-7. € 89. www.schnell-und-steiner.de

Sansavini, S., Costa, G., Gucci, R., Inglese, P., Ramina, A. and Xiloyannis, C. (eds.). 2012. Arboricoltura Generale. Patron Editore, Bologna, Italy. 534p. ISBN 9788855531894. € 55.00. www.patroneditore.com

CABI offers a discount of 25% on all CABI publications to ISHS members. Please visit <http://bookshop.cabi.org/> and enter the discount code ccishs25 when ordering a book.

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

International Conference on Pesticide Use and Risk Reduction for future IPM in Europe, 19-21 March 2013, Riva del Garda, Italy. Info: Floriana Marin, Email: floriana.marin@fmach.it, Web: futureipm.eu

NEV2013 Workshop on Nitrogen, Environment and Vegetables, 15-17 April 2013, Torino, Italy. Info: Prof. Dr. Carlo Grignani or Prof. Dr. Silvana Nicola, Dip. Agronomia, Selvicoltura e Gestione del Territorio, Università degli Studi di Torino, Via Leonardo da Vinci 44, 10095 Torino, Italy, Phone: (+39) 011 6708777 or (+39) 011 6708773, Fax: (+39) 011 2368777 or (+39) 011 2368773, Email: info@nev2013.org, Web: <http://www.nev2013.org>

BioVeg 2013 - 9th International Congress on Plant Biotechnology, 7-10 May 2013, Cuba. Info: BioVeg 2013, Centro de Bioplasmas, Ciego de Ávila, Cuba, Email: bioveg2013@bioplasmas.cu, Web: <http://bioveg.bioplasmas.cu/Default.aspx>

30th Annual Interdisciplinary Plant Group (IPG) Symposium focusing on "Root Biology", 29-31 May 2013, Columbia, Missouri, USA. Info: Victoria Bryan, Project Coordinator, Interdisciplinary Plant Group, 1-31 Agriculture Building, University of Missouri, Columbia, MO 65211, USA, Phone: +1-573-884-9320, Email: bryanvj@missouri.edu, Web: www.ipg.missouri.edu/symposium

VII Iberian Congress of Agricultural Engineering and Horticultural Sciences - Innovation and Production for the Future, 26-29 August 2013, Madrid, Spain. Info: Margarita Ruiz-Altisent or Fernando Riquelme, Email: madrid2013@geyseco.es, Web: <http://sechaging-madrid2013.org>

Vinifera EuroMaster – European Master of Science of Viticulture and Enology, September 2013. Info: Phone: +33(0)499612055, Fax: +33(0)499613043, Email: vinifera@supagro.inra.fr, Web: www.vinifera-euromaster.eu

59th Annual Meeting of the Interamerican Society for Tropical Horticulture, 2-6 September 2013, Queretaro, Mexico. Info: Dr. Carlos A. Núñez-Colín, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias,

Campo Experimental Bajío, Km. 6.5 Carretera Celaya-San Miguel de Allende, Apartado Postal 112, Celaya, Guanajuato, 38110, Mexico. Phone: +52 461 6115323 ext. 113, 134, and 135, Email: lit007a@gmail.com, Email Meeting: lixam2013@iasth.org

and Fisheries Research, Plant Sciences Unit, Crop Husbandry and Environment, Burg. van Gansberghelaan 109, 9820 Merelbeke, Belgium. Phone: +32 9 272 26 99, Fax: +32 9 272 27 01, Email: nutrihort@ilvo.vlaanderen.be, Web: www.ilvo.vlaanderen.be/nutrihort



Interamerican Society for Tropical Horticulture

NUTRIHORT: Nutrient management, innovative techniques and nutrient legislation in intensive horticulture for an improved water quality, 16-18 September 2013, Ghent, Belgium. Info: ILVO - Institute for Agricultural

32nd International Vegetable Training Course - Vegetables: From Seed to Table and Beyond, 16 September – 6 December 2013, Bangkok, Thailand. Info: AVRDC - The World Vegetable Center, East and Southeast Asia, P.O. Box 1010 (Kasetsart), Bangkok 10903, Thailand, Phone: +66 (0)2 942-8686 / 8687, Fax: +66 (0)2 942-8688, Email: info-eastasia@worldveg.org, Web: www.avrdc.org/?page_id=1439

Conference on Fruits and Roots: A Celebration and Forward Look, 6-7 November 2013, Kent, UK. Info: AAB Office, Warwick Enterprise Park, Wellesbourne, Warwick, CV35 9EF, UK, Phone: +44 (0)2476 575195, Fax: +44 (0)1789 470234, Email: russell@aab.org.uk, Web: www.aab.org.uk



SYMPOSIA AND WORKSHOPS

Second Int'l Symposium on Horticulture in Europe (SHE 2012)

The 2nd International Symposium on Horticulture in Europe was held on 1-5 July 2012 at the University of Angers' Faculty of Law, Economic and Management Building in Angers, France. This symposium was a joint meeting of the European national societies for horticultural science and was organized under the auspices of ISHS.

The original idea to hold an International Symposium on Horticulture in Europe (SHE) in



series and organize the Second Symposium in 2012 in Angers.

The region of Angers is well known and recognized for its horticultural production. It is also well known for its outstanding research capacity, including research and experimentation institutes (INRA, CTIFL, ASTREDHOR) and specialized education at Masters and PhD levels (University of Angers, AGROCAMPUS OUEST), the different education institutions being

ISHS President António Monteiro (right) handing out the ISHS Medal Award to symposium Convener Jean-Claude Mauget (left).

Prof. Errol Hewett (left) congratulating Burkard Kautz (right) with the ISHS best student presentation award.



Errol Hewett speaking at the launch of the ISHS publication *Harvesting the Sun: A Profile of World Horticulture* at SHE 2012.

2008, stemmed from a real need expressed by the European horticultural scientific community to organize a meeting where they could share the same concerns, interests and issues and establish international interdisciplinary networks in horticulture. This first symposium held in Vienna, Austria, was a great success and the decision was therefore taken to continue the



regrouped under the umbrella organization Valcampus. Moreover, all partners of the private sector and academic institutions participate in a competitiveness cluster called VEGEPOLYS, that is recognized internationally.

The general goal of SHE 2012 was to unify European strengths in the area of horticultural research and education and to increase their visibility at the international level. SHE 2012 was organized by AGROCAMPUS OUEST in partnership with INRA (Institut National de la Recherche Agronomique), CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement) and the University of Angers, with the support of VEGEPOLYS.

The objective of the meeting was to give European horticulture scientists an opportunity to exchange knowledge, information, ideas and techniques. The symposium covered all research areas relevant to horticulture in Europe: plant physiology, plant genetics and genomics, plant-environment relationships, plant and plant product quality, plant health, economics and technical engineering. The spatial scale ranged from cell level to cropping systems and landscape. The place and role of European horticulture in the world, particularly in relation to developing countries and regions, was also presented and discussed. The symposium was attended by 470 participants from 43 countries, mainly European but also from other continents.



From left to right: Dr. Gilles Galopin, representative of the Scientific Board of SNHF; Prof. Gerhard Buck-Sorlin, president of the awards jury, and Alam Mehboob, receiving the SNHF best student poster award.

The symposium was organized around six full-day scientific sessions covering the following transdisciplinary topics:

1. Contribution of innovative technologies to new developments in horticulture;
2. Consumer-driven sustainable supply chain management;
3. Conception and assessment of innovative horticultural systems, including organic horticulture;
4. Horticulture and biodiversity: contribution to its loss, conservation or increase?

5. From molecular processes to plant population functioning: towards integrative biology in horticulture;

6. Landscaping and urban horticulture.

Each session was introduced by a prestigious keynote speaker:

- Erik PEKKERIET, Wageningen UR Greenhouse Technology, The Netherlands: Contribution of innovative technologies to new developments in horticulture;
- Lena EKELUND, Swedish University of Agricultural Sciences, Alnarp, Sweden: Regional identity and authenticity as a means of reaching the European consumer;
- Kathy STEPPE, Ghent University, Belgium: Contribution of plant sensors to new developments in horticulture;
- Cristos XILOYANNIS, University of Basilicata, Italy: Sustainable production systems in fruit orchards;
- Michel PITRAT, INRA Avignon, France: Evolution of diversity of fruits and vegetables crops;
- Elias FERERES, University of Cordoba, Spain: Deficit irrigation of horticultural crops: progress and challenges;
- Gerhard BUCK-SORLIN, AGROCAMPUS OUEST, France: From molecular processes to plant population functioning: towards integrative biology in horticulture;

Professional tour participants had the opportunity to visit Gratien-Meyer Winery where they had lunch in the beautiful scenery of Loire Valley.

Photograph by Vegepolys.



- Christian ULRICHS, Humboldt University of Berlin, Germany: Recent developments in urban horticulture – facts and fiction.

All keynote speakers highlighted the challenges related to their respective themes and explained how research could solve specific problems.

During the symposium, 60 oral presentations and 362 posters were presented.

The symposium began with welcome addresses delivered by Grégoire Thomas, Director General of AGROCAMPUS OUEST, Christian Pihet, Vice President of the University of Angers, Daniel Loiseau, Vice-President of Angers Loire Métropole, António Monteiro, President of the International Society for Horticultural Science, and Jean-Claude Mauget, Convener of SHE 2012.

The opening session was chaired by António Monteiro, President of ISHS, and included a very stimulating lecture entitled "Horticulture in a crisis environment", delivered by Dr. Tomas Garcia Azcarate, Agricultural Market Economic Advisor, the European Commission.

Ten workshops provided the opportunity for less formal discussions on specific topics such as ecologically intensive horticulture, the impact of climate change on horticultural crops, horticultural potential in Eastern European countries and opportunities for horticultural research and innovation in Horizon 2020. A two-day satellite workshop on horticulture for international development took place in the facilities of AGROCAMPUS OUEST.

Two prizes were awarded during SHE 2012: the ISHS best student presentation was given to Burkard KAUTZ from Germany for his presentation: Impact of salinity and water deficiency on the fluorescence signature of tomato leaves, while the SNHF (Société Nationale d'Horticulture



During a post-symposium professional tour, participants visited Minier Nurseries in Beaufort-en-Vallée near Angers. Here they are walking in the arboretum of the nursery. Photograph by Vegepolys.

de France) best student poster was granted to Alam MEHBOOB from Sweden for his poster: Decontamination of irrigation water comparison of stationary and mobile photocatalytic water treatment.

Seven professional tours were organized for the afternoon of July 4 and the day of July 5. They enabled interested participants to discover the horticultural industry in the area of Angers and to enjoy the beautiful landscapes of Anjou.

Prof. Errol Hewett, ISHS Board member, launched the book *Harvesting the Sun: A Profile of World Horticulture* during the symposium.

The next SHE will be organized and hosted by our Greek colleagues in 2016.

Jean-Claude Mauget

CONTACT

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Section Medicinal and Aromatic Plants Third Int'l *Humulus* Symposium – Commission Plant Genetic Resources – Commission Fruits and Vegetables and Health

The historic city of Zatec (Saaz), Czech Republic, "Town of Hops", was an extremely appropriate location for the 3rd International *Humulus* Symposium, which took place from September 9-14, 2012 (the first and second symposia were held in Corvallis, USA [2004] and Ghent, Belgium [2008], respectively). Over 60 participants from 13 countries covering the entire hop research spectrum and value chain, gathered at the Hop Research Institute Co.

Ltd. Zatec, to learn and share current developments concerning this charismatic plant, *Humulus lupulus* L. The symposium was convened by Dr. Josef Patzak, Hop Research Institute Co. Ltd., Czech Republic and A/Prof. Anthony Koutoulis, University of Tasmania, Australia. Dr. Barbara Reed, Vice Chair of the ISHS Commission Plant Genetic Resources, represented the ISHS and was part of the official opening of the symposium.

SCIENTIFIC PROGRAM

The scientific program included 32 oral presentations and 25 posters covering six sections. The first section focused on **Hop Breeding and Molecular Biology**. Invited speaker, Dr. Simon Whittock (Australia), described how various technologies (in vitro polyploid induction, flow cytometry, GC-MS, molecular markers, quantitative genetics) have assisted hop breed-





Participants at the 3rd International *Humulus* Symposium in Zatec, Czech Republic.

ing efforts in Australia to develop new varieties with exciting flavor potential. Dr. Ron Beatson (New Zealand) described the genetic progress made over 50 years of breeding triploid hops for New Zealand growing conditions, with a continued focus on both alpha and aroma hops. Invited speaker, Dr. John Henning (USA), provided a detailed overview of the US Department of Agriculture, Agricultural Research Service (USDA-ARS) hop molecular breeding program, with a particular focus towards genotyping hop accessions and developing genetic maps for quantitative trait loci (QTL) studies. Dr. Emily Buck (New Zealand) described how a number of

QTL for key flavor and aroma components have been identified, illustrating the potential for marker assisted selection in hop. Invited speaker, Dr. Jaroslav Matousek (Czech Republic), provided an extremely interesting update on the gene regulation of the hop lupulin gland metabolome, with specific reference to the role of transcription factors. Research student, Andres Gatica-Arias (Germany), described a genetic engineering approach to over-expressing transcription factors with a view to increasing production of secondary metabolites in hop. Dr. Gennady Karlov (Russia) presented the application of molecular cytogenetics to investi-

gate fundamental aspects of the hop genome. The second section focused on **Plant Pathology, Virology and Entomology**. Invited speaker, Prof. Teruo Sano (Japan), presented a historical perspective of the origin and diversity of hop stunt viroid as well as current issues. Dr. Sebastjan Radisek (Slovenia) described recent outbreaks of hop stunt disease in Slovenia and how these are currently being managed. Dr. Jernej Jakse (Slovenia) described the use of next generation sequencing as a diagnostic tool for new pathogen discovery in hop. Dr. Stanislav Mandelc (Slovenia) described a comparative proteomic approach to inves-

Co-Convenor Dr. Josef Patzak (Czech Republic) introducing Dr. Barbara Reed, Vice Chair of the ISHS Commission Plant Genetic Resources and ISHS representative, at the official opening of the symposium.



Dr. Karel Krofta (Czech Republic) showing delegates part of the pilot brewing facility at the Hop Research Institute Co. Ltd.



tigate hop plants susceptible and resistant to *Verticillium albo-atrum*. Dr. Florian Weihauch (Germany) described a new biotest for assessing aphid tolerance on different aphid genotypes (in his words: “simple is beautiful”). Dr. Josef Vostrel (Czech Republic) described how organic hops can be protected from two-spotted mite with the assistance of the predatory mite *Typhlodromus pyri*.

The third section focused on **Chemistry and Plant Physiology**. Invited speaker, Dr. Martin Biedl (Germany), described chemical processes for the isolation of prenylflavonoids from hop. Dr. Clinton Dahlberg (USA) described recent efforts in the preparation of the unnatural derivatives of hop. A/Prof. Robert Shellie (Australia) compared and contrasted separation science technologies in hop, namely: high-resolution gas chromatography (GC), ultra-fast GC and comprehensive two-dimensional GC. Invited speaker, Dr. Ana Margarida Fortes (Portugal), described the potential of using organogenic nodule formation in hop as a tool for future biotechnological applications. Dr. Josef Patzak (Czech Republic) compared endogenous phytohormone levels in dwarf and standard hop. Dr. Vit Gloser (Czech Republic) presented work related to the response of hop to drought.

The fourth section focused on **Hop Cultivation and Management**. Invited speaker, Dr. Hiroo Matsui (Japan), described the influence of hop root age on the quality of hop. Dr. Karel Krofta (Czech Republic) presented work on the importance of transpiration in the overall water balance in hop plantations. Invited speaker, Dr. Barbara Reed (USA), provided an update on the cryopreservation and maintenance of hop material in the USDA germplasm collection. Dr. Luca Pretti (Italy) reported on recent hop cultivation trials in four Italian regions. Ing. Josef Jezek



Co-Conveners Dr. Josef Patzak (Czech Republic) (left) and A/Prof. Anthony Koutoulis (Australia) (right) receiving their ISHS medals at the closing ceremony of the symposium.

(Czech Republic) presented recent growth trials of low trellis hop in the Czech Republic. Dr. Ruslan Hofmann (Germany) presented recent findings on energy consumption and quality control during hop kilning.

The fifth section focused on **Hop, Indispensable Raw Material for Brewing**. Invited speaker, Dr. Jessika De Clippeleer (Belgium), presented work on the role of hop versus malt in the origin of staling aldehydes in beer. Prof. Thomas Shellhammer (USA) presented a very interesting talk on understanding the origin of American hop aroma in beer. Dr. Emily Buck (New Zealand) presented a sensory method developed from Dr. Sara Jaeger's group (New Zealand) for screening dried hop cones for specific traits. Dr. Patricia

Aron (USA) presented research on the elucidation and evaluation of hop polyphenol influence on lager beer flavor and flavor stability. Dr. Jan Urban (USA) presented recent research describing, in detail, the molecular structure of humulone and several of its derivatives.

The sixth section focused on **Hop, Beer and Health**. Prof. Herbert Riepl (Germany) presented research on the screening of hop extracts for substances active in neural stem cell differentiation. Dr. Pavel Dostalek (Czech Republic) described the effect of xanthohumol on brewing yeast cells.

SOCIAL ACTIVITIES

During the symposium the local organizing committee ensured that the scientific presentations were complemented by social activities that were of great interest to everyone, including sampling the quality of the end product of their work – beer. Many of these social events were based at the Hop Research Institute, where delegates were able to sample some of the local brews generated at the Institute's pilot brewing facility. Our hosts at the Hop Research Institute were very generous with their time and they opened up the laboratory facilities for inspection. Delegates were also entertained by a choir at a local church in Zatec and enjoyed the excursion to local hop gardens followed by a tour of the Zatec hop museum and finishing with some local Czech beers at the appropriately named Hop and Beer Temple. A highlight of the farewell party was a demonstration of traditional beer brewing. A select group of hop enthusiasts were able to attend the post-symposium tour, which included tours of the Pilsner Urquell brewery and Pilsner Urquell brewery museum in Plzen (Pilsen), the charming town of Karlovy Vary (Carlsbad), the historic city of Praha (Prague) and the large Gothic Karlstejn Castle.

FUTURE PROSPECTS

During the ISHS business meeting, discussions were held regarding the 4th International *Humulus* Symposium and how this fitted in with other international hop meetings. Details of the discussions will be conveyed to the ISHS Executive Committee.

Anthony Koutoulis and Josef Patzak

CONTACT

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Dr. Josef Patzak, Co-Convenor, Hop Research Institute Co. Ltd., Kadanska 2525, Zatec 43846, Czech Republic, email: patzak@chizatec.cz

Dr. Ron Beatson (New Zealand) inspecting hops (left) and “stirring the pot” (right) during the demonstration of traditional beer brewing.



Section Nuts and Mediterranean Climate Fruits

Fifth Int'l Chestnut Symposium



Participants of the Fifth International Chestnut Symposium.

The National Conservation Training Center in Shepherdstown, West Virginia (USA) was the venue for the Fifth International Chestnut Symposium, held September 4-8, 2012. The symposium was organized by West Virginia University and sponsored by ISHS, The American Chestnut Foundation, the United States Department of Agriculture and the Chestnut Growers, Inc. of Michigan (USA). The symposium was attended by nearly 100 individuals representing eight countries and twenty-one U.S. states. The symposium opened Tuesday, September 4, 2012 with a keynote address by James Hill Craddock, University of Tennessee, Chattanooga, TN (USA). Welcome remarks were made by: Jay Slack, Director of the National Conservation Training Center; Daniel Robison, Dean, Davis College of Agriculture, Natural Resources and Design, West Virginia University; Gale McGranahan, Vice Chair ISHS Section Nuts and Mediterranean Climate Fruits; and, Bryan Burhans, President and Chief Executive Officer of The American Chestnut Foundation. Thirty-seven oral presentations were made in the following categories: *Cryphonectria/*

Hypovirulence; Pests and Pathogens; Breeding, Genetics and Genomics; Forest Health Initiative; Food Science; and, Propagation and Orchard

ISHS representative Gale McGranahan (center, UC-Davis, USA) presents awards to co-conveners, Mark Double (left) and William MacDonald (right), West Virginia University (USA).



Management. Twenty-eight poster presentations also were made in the same categories. One highlight of the meeting was the forum on the Forest Health Initiative. Dana Nelson of the United States Department of Agriculture-Forest Service spoke on using American chestnut as a model for forest tree restoration. Charles Addo-Quaye of Penn State University (USA) provided an overview of the Chinese chestnut genome project, while Albert Abbott of Clemson University (USA) detailed the genetic and physical mapping of Chinese chestnut in search for candidate genes for resistance to chestnut blight and ink disease. The use of somatic embryogenesis and gene transfer to help restore American chestnut was provided by Dana Nelson. William Powell, State University of New York, Syracuse (USA), closed the session by giving an overview of developing transgenic American chestnut to enhance blight resistance. Three half-day field trips were offered on September 6. The USDA Appalachian Fruit Station in West Virginia offered participants the opportunity to learn about: (1) protectant



• Cevriye Mert, Ümit Serdar and Ümran Ertürk display Turkish candy at the symposium in West Virginia.



• Professor Dennis Fulbright (right, green shirt, Michigan State University, USA), describes blight infections on American chestnut sprouts that grew from irradiated seed.

coating (particularly clay) to reduce transpiration, thereby protecting fruit trees during dry periods; (2) strategies to control the brown marmorated stink bug; (3) the development of transgenic plums for the control of plum pox;

• Wugang Huang and Qin Ling (Beijing, China) examine leaves in a backcross breeding orchard.



(4) breeding of apples for scab and fireblight resistance; and (5) a mechanical trellis system to extend the growing season for blackberries and facilitate their harvest. The second option was a tour of Antietam National Battlefield (U.S. Civil War site) in Sharpsburg, Maryland. The final offering was a tour of the National Conservation Training Center Archives. The field trip on September 7 included visits to an irradiated American chestnut plantation and a backcross breeding orchard containing offspring of American chestnuts that resulted from crosses with resistant Chinese chestnut. The goal of the orchard planting is to seek American-like trees that have American form and high levels of resistance to blight.

Gale McGranahan (University of California-Davis, USA) delivered the ISHS medal to co-conveners William MacDonald and Mark Double, West Virginia University (USA).

Special presentations were made to announce

the Second European Chestnut Congress in Debrecen, Hungary in 2013 and the International Horticulture Congress in Brisbane, Australia in 2014.

Ümit Serdar, on behalf of the delegation from Turkey, agreed to convene the Sixth International Chestnut Symposium in 2016. The meeting will be organized by Ondokuz Mayıs University and convene in Samsun, Turkey.

Mark Double

CONTACT

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Section Ornamental Plants

Fifteenth Int'l Protea Association Conference and Eleventh Int'l Protea Research Symposium



Participants from eleven production areas worldwide attended the symposium held in April of 2012 in Santiago, Chile.

About 45 researchers and representatives from the Protea industry attended this symposium. They came from several protea producing areas and countries: South Africa, Australia, Zimbabwe, New Zealand, Chinese

Taipei, California, Hawaii, Canary Islands, Peru, Ecuador and Chile. The symposium was held in Santiago, Chile, from the 23rd to the 26th of April, 2012 and was organized by Eduardo Olate from the Pontificia Universidad Católica

Dr. Audrey Gerber, President of the International Protea Association, gives the inaugural address to the XV International Protea Association Conference and XI International Protea Research Symposium.



de Chile and Flavia Schiappacasse from the Universidad de Talca, supported by members of the International Protea Association (IPA) and the Scientific Committee of the International Protea Working Group (IPWG).

This special group of plants has several features that stimulate research and their cultivation around the world. There is good industry demand for protea flowers due to their charm and beauty, and plants are grown both for their flowers and as pot and garden plants.

A welcoming reception was held on the evening of Sunday 22. The next morning there was a field trip to visit the Agricultural and Livestock Sanitary Service (SAG) and USDA inspection facilities at Santiago Airport, where the participants could learn about the import and export procedures for plant propagation and cut flower material. All export material to be sent to the U.S. or any other country is strictly inspected in Chile by SAG or USDA, avoiding rejections at the destination. The participants also had the chance during this visit to witness an inspection of cut flowers coming from Ecuador. Later, the participants visited some protea farms, including Flores del Fynbos Ranch near San Antonio, Proteas del Mar Ranch in Pichilemu, and Doberti's Ranch near Litueche. All the growers visited during the field trip cultivated African and Australian species for cut flower and cut foliage.

The opening ceremony began with some introductory remarks by the President of the

Participants during a visit to one of the farms in Chile addressing common production problems.





Many *Leucadendron* species and cultivars are grown at this trial plantation at San Vicente Ranch in Litueche (Chile). Dr. Guijun Yan (Australia) observes the plantation while Rua Petty from California discusses some growing aspects with Antonio Doberti and Luis Octavio Polanco (Chile).

International Protea Association, Dr. Audrey Gerber. She was followed by Dr. Margrethe Serek, postharvest researcher and also Chair of the ISHS Section Ornamental Plants, who referred to all the activities programmed for the following months and stressed that this is the only group of the Section that meets every two years. Mr. Dick Houter, Treasurer of APEF (Chilean Flower Growers and Exporters Association), was invited to give a talk on the challenges and opportunities that face the Chilean cut flower industry.

Lectures and posters were presented in the sessions on "Propagation, Flowering and Production, Postharvest and Breeding". Guijan Yan, from the University of Western Australia, explained how DNA technology is being applied in breeding programs. Bettina Gollnow, horticultural consultant, explained the wildflower quality specifications and accompanying postharvest manual developed by the Department of Primary Industries, New South Wales, Australia. *Phytophthora* resistance was a recurrent subject during the conference; there is hope that in the future it will be possible to breed resistant plants. Another subject that was addressed, was Protea leaf blackening, one of

the major postharvest problems of this species. Interestingly, it appeared that it is possible to mitigate the problem by harvesting the stems in the afternoon and submitting them to 10% glucose pulses. A highlight of the symposium was the presentation of new leucadendron cultivars bred in South Africa.

The Organizing Committee acknowledged all the oral and poster presentations and valuable discussions that took place during the symposium activities.

Eduardo Olate and Flavia Schiappacasse

CONTACT

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Section Ornamental Plants – Commission Landscape and Urban Horticulture Second Int'l Symposium on Woody Ornamentals of the Temperate Zone



Participants of the symposium.

The importance of woody ornamentals cannot be underestimated. They contribute immensely to our recreational needs and the quality of life in urban dwellings. They have aes-

thetic and functional uses in both landscapes and gardens, they ameliorate climate, abate the harmful aspects of pollution, prevent erosion, and provide many other benefits. Nursery

stock production represents an important economic activity within the horticultural sector; it is an expanding SECTOR with specific needs for future developments. This was the central





Technical visit to the Research Centre for Ornamental Plants (PCS).



Visit to a nursery.

theme of the II International Symposium on Woody Ornamentals of the Temperate Zone, which was held from July 1 to 4 in Ghent, Belgium. Around 160 participants attended the symposium, representing 30 countries.

In the plenary session Nico Dolmans (The Netherlands) highlighted the challenges and perspectives nursery stock production is facing. Today's challenges include optimal production with less input of water, fertilizers and pesticides, maintaining soil quality in open field production, monitoring of new pests and diseases, automation and efficient production, and the need for skilled and specialized workers. For instance, solutions can be found in integrated pest control, soilless and closed production systems, efficient systems for irrigation and mineral application, GPS-based precision techniques, automation and efficient logistics and chain management. Close cooperation between researchers and growers is necessary to reach

a real transition toward sustainable production and to develop new solutions.

The symposium held 6 sessions covering IPM, pests and diseases; plant physiology and climate change; breeding and biodiversity; water, nutrients and substrates; propagation and landscape and urban horticulture.

New opportunities for monitoring pests in woody ornamentals using pheromones were demonstrated. In combination with alert warning systems this leads to adequate integrated pest management. Emerging pests and diseases must be monitored and controlled. In some cases, disease resistance breeding might be the ultimate solution.

Freezing is a major environmental stress that can induce significant economic losses in woody stock production and established ornamentals. The timing and extent of seasonal cold acclimation and deacclimation are of critical importance for winter survival, particularly in view of climate change. New insights into the physiology and underlying cellular mechanisms of cold acclimation, deacclimation and reacclimation in *Rhododendron* and the sustainability of plant sources under changing climate conditions were explained.

Recent advances in molecular technologies, including gene expression and genome sequencing, are being used in woody ornamental research and offer exciting new possibilities. These new tools will undoubtedly lead to a better understanding of different physiological processes and the development of more efficient breeding systems. In a not so distant future the understanding of molecular processes underlying ageing and adventitious root formation will certainly improve propagation protocols.

Moreover, improving water use efficiency in the nurseries has become a high priority as water becomes a scarce resource and water use restrictions and environmental regulations are becoming more stringent. Novel irrigation strategies play a key role in enhancing efficient water use. It was shown that in the future, sophisticated mechanistic water transport models can assist plant-based irrigation scheduling.

The symposium also included a field trip to showcase the woody ornamental research in Belgium. At the Institute for Agricultural and Fisheries Research (ILVO), breeding activities (woody ornamentals, *Rhododendron*, roses), tissue culture and biotech related research were displayed. Research on improving identification of plant pathogens, on plant/pathogen relationships and on alternatives to the chemical control of pathogens in various cropping systems were highlighted. The Research Centre for Ornamental Plants (PCS) carries out applied scientific and practice-oriented research. Important themes were optimization of culture methods, growth and flowering regulation and environmental protection. This included closed culture systems, minimizing the use of chemical products and the observation and warning systems for pests and diseases in nursery stock.

One of the goals of the symposium was to be a forum where both scientists and growers could meet and share new developments in hardy nursery stock research. Therefore, the organisers were delighted that The European Nursery Stock Association (ENA), which held its yearly meeting at the same time in Ghent, attended the plenary session and participated in the technical tour with a delegation of 30 people, representing 17 European countries. A workshop for Belgian nursery growers also took place at the same time. The network reception was very much a meeting place for industry and science.

Finally, participants had the chance to discover the dynamic and innovative woody ornamental industry in Belgium via one of the post-symposium tours.

Johan Van Huylenbroeck

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Dr. Gert Groening, Chair of the ISHS Commission Landscape and Urban Horticulture (right) handing out the ISHS medal award to symposium Convener Dr. Johan Van Huylenbroeck (left).



Section Ornamental Plants – Commission Landscape and Urban Horticulture – Commission Plant Genetic Resources

Seventh Int'l Symposium on New Floricultural Crops



Participants of the symposium in Puerto Madero, Buenos Aires.

The VII International Symposium on New Floricultural Crops was held in Buenos Aires city, Argentina from 22 to 25 November 2011. The conference centre was in Puerto Madero, the most modern and exclusive corner of the city. This symposium was organized by the Institute of Floriculture that belongs to the National Institute of Agricultural Technology (INTA), Argentina. The aim of the symposium was to be a platform to exchange knowledge among scientists specialized in the development of new ornamental crops from all over the world.

The introduction of a new floricultural crop is a long process that involves many steps including exploration and collection of ornamental genetic resources, domestication and characterization, classical breeding and biotechnology, propagation, crop management, market research, etc. The floriculture industry is very dynamic and constantly seeks new products. For all these reasons five sessions covering the following topics were planned:

Session 1: Ornamental genetic resources: the potential to become a new crop

Session 2: Germplasm characterization and ornamental value

Session 3: Domestication, propagation and production of new species

Session 4: Ornamental breeding and biotechnology

Session 5: Market trends and breeders rights
More than 120 scientists, technicians and students participated in the event. During the symposium delegates were informed of the latest results of researchers from universities, institutes and private companies representing more than 20 countries.

Dr. Margrethe Serek, Chair of the ISHS Section

on Ornamental Plants, introduced activities, commissions, sections and working groups of ISHS, emphasizing the New Ornamentals Working Group.

Seven invited lectures, twenty oral communications and more than 100 poster presentations were made during the meeting. These contributions were gathered in a book of abstracts

Poster room, more than 100 posters were presented.





Exhibition of new cultivars developed from flora native to Argentina at the Institute of Floriculture, INTA, Castelar.

available at: <http://inta.gov.ar/documentos/vii-simposio-internacional-sobre-nuevos-cultivos-ornamentales-vii-international-symposium-new-floricultural-crops/>.

Dr. Margherita Beruto presented an interesting lecture about the role of innovation in floriculture and the need for a comprehensive approach considering plant science, market expertise, new technologies and environmental sustainability. Dr. Gabriela Verdugo presented the experience of Chile in ornamental breeding of native species such as *Leucocoryne*, *Rhodophiala*, *Alstroemeria* and *Chloraea*.

A lecture entitled "Development of new plant

variety in view of the convention on biological diversity - our experience in Argentina and research perspective", presented by Dr. Tomoshiro Kamogawa, was greatly appreciated by the audience and Dr. Richard Schoellhorn (Proven Winners) emphasized that it was a real case of a benefit sharing agreement model.

The organizing committee also decided to include in the program time for reflecting on research perspectives in the field of new ornamental crops. Dr. Mark Roh was thus invited to present a lecture entitled "The direction of new floral crops research - reflections on the past and future prospects".

Participants enjoyed a technical visit to the Institute of Floriculture where an exhibition of Argentinian native species and cultivars was displayed. The breeding program focuses on favorable ornamental characteristics such as a compact shape, long flowering periods, and simplicity of management. In the experimental field, participants saw improved materials of *Calibrachoa*, *Glandularia*, *Mecardonia*, *Nierembergia* and other native species with ornamental potential. In the greenhouses, cultivars of these genera and of *Seemannia* that have been adapted for pot plant use were displayed. Also, a collection of native ferns was shown.

A beautiful exhibition of scientific illustrations was organized by Alejandra Migoya and Adriana Kato. Moreover, twenty-two authors from five countries presented their work. A photo gallery of Florencia Cesio named "Portrait of Native Flora" was on display in the symposium venue.

Finally, a symposium in Argentina could not finish well without Tango music. Hence, participants were introduced to the history of this music during a gala dinner.

Gabriela Facciuto

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Section Ornamental Plants - Commission Plant Genetic Resources

First Int'l Conference on Germplasm of Ornamentals

The First International Conference on Germplasm of Ornamentals was held successfully on July 16-20, 2012 in Beijing, China. This conference was organized by the Beijing Forestry University, the University of Western Australia, the Chinese National Engineering Research Centre for Floriculture, the Beijing Botanical Garden and the Ornamental Committee of the Chinese Society for Horticultural Science, under the auspices of the International Society for Horticultural Science. The conference was also supported by the Chinese Ministry of Education, the Beijing Municipal Administration Center of Parks, the Summer Palace and Old Summer Palace Management Centre and the Plant Development Services Incorporated.

The objective of the conference was to discuss the rational exploitation and utilization of germ-

Hannah Jaenicke, Chair of ISHS Commission on Plant Genetic Resources, delivering an award certificate and a medal to Prof. Zhang Qixiang, Convener.



plasm of ornamental plants. Topics ranged from new floriculture crops, genetics and breeding, and genetic diversity to utilization of genetic resources. The conference also aimed to offer an opportunity for experts and scholars from all over the world to exchange ideas about various issues related to ornamental germplasm.

The conference was attended by 108 participants, including 86 formally registered representatives (41 of them were students), coming from 10 countries and regions in Asia, Europe, America and Oceania. During the opening ceremony, Prof. Zhang Qixiang, the Convener of the conference, delivered the opening speech. Prof. Song Weiming, the President of the Beijing Forestry University, also attended the ceremony and congratulated the organizers for putting together such an important conference.



Participants of the conference.

Several experts and scholars from across the world were invited to give speeches to the attendees. They included Hannah Jaenicke (Germany), the Chair of the ISHS Commission on Plant Genetic Resources, Prof. Hong Deyuan (China), the Academician of the Chinese Academy of Sciences, Prof. Zhang Qixiang (China), the Vice President of the Beijing Forestry University and expert in ornamental plants, Kenneth W. Leonhardt (USA), the expert in tropical floriculture crops of *Proteaceae*, and Byoung Ryong Jeong (Korea), the expert in plant tissue culture. More than 30 other experts and scholars delivered oral presentations related to their own fields of research. Forty-three post-

ers were displayed at the conference, and the participants were given a lot of opportunities to interact. Amongst the student participants, Jing Shan was awarded the best oral presentation, and Hong Yan and Yue Yuechong were awarded the best poster presentations. The conference, featuring high quality oral and poster presentations, created a wonderful academic atmosphere.

The conference received 123 abstracts from which 100 were selected for oral and poster presentation. Fifty-four manuscripts were received at the conference and they are currently being reviewed for publication in *Acta Horticulturae* before the end of this year.

The technical visits and farewell banquet gave the participants the chance to learn more about China and the local people. The first technical visit included trips to the Summer Palace and Old Summer Palace. During the second visit to the Beijing Botanical Garden participants enjoyed and learned a great deal about aspects of plant resources in China by visiting the Public Plant Conservatory. On the evening of July 19, the participants were invited to a farewell banquet at which dancers from Chinese minorities performed (Dai people and Yi people), and displays of Sichuan "Changing Face" opera and Chinese Kungfu were presented, enabling the guests to have a taste of traditional Chinese culture.

Visit to the Old Summer Palace.





Opening ceremony attended by experts and scholars during the welcome speech of the Convener Prof. Dr. Zhang Qixiang.



Visit to Beijing Botanical Garden.

Based on a small survey conducted at the end of the conference, participants and accompanying persons felt that they greatly enjoyed the meeting and their stay in Beijing. They spoke highly of the conference organization, the quality of the technical visits and other entertainment, as well as the hospitality of the people of Beijing. On July 19, Hannah Jaenicke, the Chair of the ISHS Commission on Plant Genetic Resources, hosted the business meeting, in which Prof. Zhang Qixiang was elected as the

new Chairperson of the Working Group on Ornamental Genetic Resources.

Lastly, we would like to express our gratitude to those who have supported us! With the joint effort of all the supporting people and institutions, the First International Conference on Germplasm of Ornamentals, having achieved its planned objectives, turned out to be a great success.

Zhang Qixiang, Yan Guijun and Yu Chao

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Section Ornamental Plants - Thirteenth Int'l Symposium on Virus Diseases of Ornamental Plants

The 13th International Symposium on Virus Diseases of Ornamental Plants took place in Norway, June 24-29, 2012 at Ski and Grimstad. More than 50 participants from 20 countries found their way to Norway for this last week of June. The symposium started with two intensive days at Ski on Monday and Tuesday. On Wednesday we visited two growers and a horticultural college before we ended up in Grimstad on the south coast.

During this meeting we listened to many talks ranging from applied virology (such as detection methods and diagnostics) to the more fundamentally oriented research topics. In addition, we had the great honor to have a broad range of guest speakers who enlightened us on many aspects of plant virology.

The meeting was opened with a plenary talk given by Dr. Robert Owens, who took us through a journey of the discovery of one of the most amazing plant pathogens: viroids. Subsequently, as part of the "Virus-Host Interaction" section, Dr. Eugene Savenkov gave us an insight into how virus-encoded protein can interfere with plant development, and

Participants of ISVDOP13 at Thon hotel Ski. Photo by Erling Floistad.





Dr. Chin-An Chang, Chair of the ISHS Working Group on Virus Diseases of Ornamentals, awarding the ISHS medal to Dr. Dag-Ragnar Blystad, Symposium Convener. Photo by Erling Floistad.



Dr. Jihong Liu Clarke presenting her talk: "Production of compact poinsettias without phytoplasma and chemical spray" during the session on Viroids and Phytoplasma, chaired by Ko Verhoeven. Photo by Erling Floistad.

Dr. Sek Man Wong presented the role of micro-RNAs in virus resistance.

On Tuesday morning, Dr. Qiaochun Wang presented the latest advances in the use of "cryotherapy" to generate virus-free material, and on Thursday morning we heard two interesting talks presented by Dr. Jan Kreuze and Dr. Holger Jeske on the use of deep sequencing as a method to detect and discover viruses.

Finally, on Friday morning, Dr. Abed Gera gave an overview of the detection and identification of viruses in ornamental plant production. These talks and all the other presentations (25 presentations and three posters) covered a broad overview of different topics related to virus and virus-like diseases of ornamentals.

This meeting was not only about science, but was also a social event at which "virologists" could mingle. On Wednesday all were welcomed to the flower producer Schrader, the nursery of Titlestad, and the horticultural college Gjennestad. Each organization provided insights into their specialties and market strategies. On Thursday the group visited the G3 Ungplanter Company in Grimstad, where they were offered lunch and were given a tour of their production of small plants and their research projects. In the evening all enjoyed a guided tour of the region by Jon Fløistad, before a visit to a reputed microbrewery and the symposium dinner with the best of Norwegian cuisine.

The organizers are indebted to all of the sponsors who provided financial support to the symposium, and in particular: Bioreba, Agdia, Loewe, NGF (association of Norwegian growers), G3 Ungplanter, Sagaplant, Mester Grønn,



Visit to the horticultural college Gjennestad. Photo by Erling Floistad.

JBU Umland, the County of Aust-Agder and the municipality of Grimstad and Bioforsk.

All participants expressed their satisfaction with the organization and arrangements. The organizers are grateful for having had the honor of hosting such an interesting symposium!

For more info please visit the ISVDOP 13 web site: <http://www.bioforsk.no/ISVDOP13>

Dag-Ragnar Blystad, on behalf of the Organizing Committee at Bioforsk

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Section Pome and Stone Fruits – Section Tropical and Subtropical Fruits

Seventh Int'l Symposium on Mineral Nutrition of Fruit Crops



Opening ceremony: from left Frank Peryea, outgoing Chairman of the ISHS Working Group on Mineral Nutrition of Fruit Crops, Sumitra Poovarodom, Symposium Convener, and Narong Theerachantharangkul, Chanthaburi Vice Governor.



Dr. Massimo Tagliavini presenting the ISHS certificate and medal to Dr. Sumitra Poovarodom, Symposium Convener.

The 7th International Symposium on Mineral Nutrition of Fruit Crops was held successfully from May 22-25, 2012 at the Maneechan Resort in Chanthaburi, Thailand. Chanthaburi is the largest commercial production area for exotic tropical fruits such as durian, mangosteen and rambutan. The symposium was organized by the King Mongkut's Institute of Technology Ladkrabang (KMILT), the Horticultural Science Society of Thailand (HSST), and the Soil and Fertilizer Society of Thailand (SFST), under the aegis of the ISHS Working Group on Mineral Nutrition of Fruit Crops of the ISHS Section Pome and Stone Fruits.

The symposium was funded by KMILT, HSST and SFST and the main sponsors were Napnutriscience, Thai Fertilizer and Agricultural Supplies Association Yara (Thailand), Q.Yield Associated, Soinc Essential, Padaeng Industry, and New Ag International. The symposium was attended by 155 delegates from both public and private sectors. Eighty participants were from Thailand and 75 were from 27 other countries: Australia, Brazil, Canada, China, Denmark, Egypt, France, Germany, Hungary, India, Iran, Israel, Italy, Japan, Jordan, Malaysia, New Zealand, Norway, Slovenia, South Africa, Spain, Chinese Taipei, Tunisia, Turkey, United Kingdom, United States, and Vietnam. The symposium represented the first-ever Asian-based meeting of the ISHS Working Group on Mineral Nutrition of Fruit Crops. As a result, the mem-

bers of the working group had the pleasure of meeting and interacting with a large number of excellent researchers from Asian countries who had not attended previous working group symposia.

The symposium opened with welcome addresses by Mr. Narong Theerachantharangkul on behalf of the Chanthaburi Governor, Dr. Frank Peryea (USA), outgoing Chairman of the ISHS working group, and the Convener Dr. Sumitra Poovarodom (Thailand). During the next several days, there were 24 oral presentations and 37 posters. Presentations during the symposium reported on recent advances in the study of fruit tree physiology, nutrient management, interaction and diagnosis of plant nutrient status, and the interactions between plant mineral nutrition and fruit quality and bioactive compounds. Reflecting the broadened mandate of the working group established in 2004, the research covered tropical and subtropical fruit as well as temperate region fruit crops. Of particular note were the insightful presentations of the eight invited speakers: Suntaree Yingjajavan (Thailand), Toru Matoh (Japan), Massimo Tagliavini (Italy), Esmaeil Fallahi (USA), Thomas Eichert (Germany), Xu-Ming Huang (China), Shela Gorinstein (Israel), and Denise Neilsen (Canada). The closing lecture by Dr. Denise Neilsen addressed the challenges and opportunities that climate change will impose on the future distribution and production of

perennial fruit crops. Dr. Massimo Tagliavini, incoming chairman of the ISHS working group, conducted the symposium award ceremony on behalf of ISHS.

A one-day mid-symposium field tour was organized for all participants to visit durian, mangosteen and snake fruit (salak) tropical fruit orchards in Chanthaburi and Rayong provinces. This excursion allowed attendees to view firsthand these exotic fruits in their native orchard environments, and to learn about their nutrient and cultural management as well as harvesting practices. For many attendees, this was the first opportunity to experience the striking flavors and textures of these fruits, particularly the mild-flavored cultivar of durian, which belied its unjustified reputation. The challenges of harvesting the large, heavy and thorny durian fruits (by dropping the cut fruit into a jute sack held by another person on the ground) also elicited particular comment. In the afternoon, participants visited the Kung Krabaen Bay Royal Development Study Centre to view the mangrove reforestation project designed to stabilize degraded marine shorelines. The day ended with a poolside farewell party at Maneechan Resort.

A pre-symposium tour led by Dr. Wichien Chatupote was conducted from May 19-21, 2012 to visit some of the most important fruit production sites of Thailand. Thirty participants from different nationalities joined this informa-



Visit to durian orchard. A worker with jute sack used to catch durian fruit.



Visit to an oil palm plantation on raised beds bordered by canals.

tive tour. The tour departed from Bangkok with a first stop at the historic ruin of Ayutthaya, a former capital of Thailand and a UNESCO World Heritage site, followed by a whimsical but surprisingly enjoyable elephant ride. Turning to topics more directly related to the symposium, the tour participants visited an oil palm plantation on raised beds bordered by canals, which, because of the extremely acidic soil and use of motorboats for farm operations, stimulated many discussions. Later, stops in the cooler upland growing areas included custard apple, pomelo and longan orchards along the scenic route to Chanthaburi. The tour allowed participants from more temperate climates to learn about and taste some tropical fruits. The growers were very interested and keen to learn, which prompted considerable discussion about possible ways to improve management practices. A stop at a commercial mushroom-growing facility gave tour participants a novel opportu-

nity to learn of the types and culture of various culinary and medicinal mushrooms. Participants of the tour also visited a Thai silk factory where the silk fabric is made using traditional wooden handlooms.

The business meeting took place at the end of the second day, including a discussion on the organization and location of the next Mineral Nutrition of Fruit Crops Symposium. Prof. Bekir Erol Ak of the University of Harran, Turkey, expressed interest on behalf of his institution in hosting the next symposium. It was so agreed by the delegates. In addition, a steering committee of senior international scientists was created to facilitate the organization of the next scientific program.

Paralleling the scientific program were social and cultural components of the symposium. The welcome reception was hosted by HSST and SFST on the first day of the symposium,

while the farewell dinner was on the third day. The warm and friendly atmosphere proved to be a most enjoyable part of the symposium for everyone who attended.

Sumitra Poovarodom and Frank J. Peryea

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Section Vegetables

Twelfth Int'l Symposium on the Processing Tomato

The theme of the 12th International Symposium on the Processing Tomato was "Adapting to a changing world: ideas, challenges and solutions". It was held alongside the 10th World Congress on Processing Tomato on 9-11 June 2012. The symposium was jointly organized by ISHS and the World Processing Tomato Council (WPTC), hosted by COFCO Tunhe and co-convened by Dr. Guitong Li from the China Agricultural University, China, and Dr. Montaña Cámara from the University Complutense of Madrid, Spain. Our goal was to bring together the world's academics,

researchers, students, growers and businessmen involved in processing tomato, to share the current state-of-the-art knowledge about this important industry. This goal was achieved as approximately 300 people participated in this symposium.

The symposium began before the start of the Congress, with a very well attended keynote session focusing on the new challenges facing the processing tomato sector. The three keynote speakers were Dr. Martine Padilla, from IAMM, France, who spoke on sustainable development, Dr. Bob Gilbertson, from UC Davis, USA, focus-

ing on diseases and viruses and Dr. Junming Li, from IVF, CAAS, China, who presented a great overview of the research on tomato processing in China.

To encourage the participation of promising young scientists working on tomato research, the "Melcoptor Young Scientists Award" was presented to five young scientists from the Mediterranean area. The recipients were Daniele Massa from Italy, Virginia Fernandez-Ruiz from Spain, David Page and Giulia Palma from France, and Rozbeh Farhoudi from Iran. The Melcoptor EU fund covered registration





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 Mrs. Sophie Colvine, General Secretary of AMITOM & WPTC, awarded the ISHS medal to Co-Conveners Dr. Guitong Li and Dr. Montaña Cámara during the opening ceremony.



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 Dr. Montaña Cámara, Co-Convenor of the symposium, presented the Melcoptor Young Scientists Awards during the opening ceremony.

and partial travel costs of the recipients. The first "Bernard Bièche Memorial Award" was also awarded to Adriano Battilani (Italy) for his involvement in tomato research and for the excellence of his contributions to previous ISHS tomato symposia.

Twenty-five oral presentations and 24 posters were presented at the symposium, focusing on the themes of (1) Plant Nutrition, Irrigation & Stress and Diseases, (2) Processing & Technology, (3) Tomato and Health, Human Nutrition & Consumer Trends.

Tomato planting is the first step in the tomato processing industry, and fertilization, irrigation and disease control are the most important aspects. In the first theme of "Plant Nutrition, Irrigation & Stress and Diseases," 13 oral and 17 poster presentations were presented on nitrogen

management, fertigation strategy decision system, organic farming practices, new irrigation method (PRD & DI), special fertilizer (silicon), and fruit hygiene and quality under waste water irrigation in tomato plantings. Facing the pressure of climate change, planting tomato with less carbon cost is the greatest challenge in the tomato processing industry. In developing countries lacking fresh irrigation water, reusing treated wastewater in vegetable production is an unavoidable choice, and food safety is the most important issue under these circumstances.

Changes in nutrient value and development in equipment and techniques were the main issues in theme 2 "Processing & Technology". There were 4 oral and 2 poster presentations on heat and sun-drying pre-treatment, lycopene stability, new packaging, and lycopene-containing products.

Human health is always an important topic, especially in developed countries and fast-growing economies like China. There were 12 oral and 5 poster presentations in theme 3 "Tomato and Health, Human Nutrition & Consumer Trends". These reports included tomato products and women's health, functional properties of tomato lycopene and polyphenol, lycopene content for disease prevention, lycopene bio-availability, antioxidant property of lycopene, evaluation of the nutritional value of tomato products, and lycopene effects on skin and reduction of fatigue. The increasing interest in nutritional issues indicates the relevance of research in horticulture linked to human health.

For all of us, the symposium was an excellent opportunity to network with leading scientists as well as tomato industry representatives from around the world. We are sure all scientific papers to be published in *Acta Horticulturae* will be of great value for everybody involved in tomato research. We are already working on the next symposium, which will take place on the shores of Lake Garda in Italy in June 2014.

Guitong Li and Montaña Cámara Hurtado

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 Participants during a lecture.



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Section Vegetables – Commission Protected Cultivation

Sixth Int'l Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops (SEST 2012)



Participants of the symposium.

It is well known that Brazilian agricultural sciences have played a prominent role in turning Brazil into a world leader in tropical agriculture. Horticultural science has surely taken a part in the accomplishment of Brazil being the 6th most important economy in the world. Still, there are several challenges to be faced: producing enough food that meets quality and safety standards for a growing world population; using finite natural resources more efficiently; coping with acidic soils; adapting horticulture to a changing climate. In other words, the challenge is to develop a truly sustainable and productive horticulture that can thrive in a changing world.

Brazil, due to its continental size and its ecological and climatic diversity, is a natural laboratory for evaluating the problems and developing the solutions for tropical and subtropical horticulture. For those unfamiliar with the tropics, the Sixth International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops, held in Brasilia, Brazil on 1-5 July 2012, was an excellent opportunity to learn about the unique problems faced by tropical horticultural sciences and the solutions found to those problems.

As most vegetable crops cultivated in Brazil come from temperate or subtropical regions, plant breeders and horticulturists must deal

with the challenge of adapting them to warmer and more humid climatic conditions predominant in tropical countries. That's what renowned Brazilian tomato breeder, Embrapa's Leonardo Boiteux, talked about in his keynote lecture, "Breeding tomatoes for tropical conditions: advances, drawbacks, and perspectives". Professor Denise Cunha and Dr. Warley Nascimento also spoke about their experience

concerning seed quality and stand establishment of vegetable crops under tropical conditions.

Solutions should not be limited to improving crops, especially if concerns about food security are to be taken seriously, and alternatives should be available. Several countries have successfully coped with plant diseases by developing and using techniques such as grafting, and

Technical visit at Alvorada's Farm: direct transplanting of processing tomato.





• Symposium Convener Dr. Warley M. Nascimento speaking at SEST 2012.



• Poster session.

examples were presented by Chinese, Spanish and Brazilian scientists.

Although new solutions and points of view are important and welcome, one has to learn from those who have dealt for a longer time with similar problems under different conditions. Recent advances in seed, transplant and stand establishment of horticultural crops in the United States were presented by Dr. Daniel Cantliffe from the University of Florida and Dr. Mark Bennett from Ohio State University. The case of the burgeoning vegetable seed production industry in Chile was presented by Dr. Samuel Contreras.

Due to recent urbanization of the Brazilian population, as well as a general increase in income, concerns about the environmental

impact of vegetable crop production has also increased and much attention has been given to agroecological management systems, such as organic horticulture. Research information on this kind of system is still needed, especially on seed production and in this respect, Dr. Steven Groot's lecture on "Challenges with organic seed production" could not have been timelier.

There were posters reporting research on seed, transplant and stand establishment from several countries besides Brazil, but the presence of numerous Brazilian scientists and students was certainly noted. This was the first time SEST had been held in South America and undoubtedly all that was presented and discussed will be more than useful in guiding future research on vegetable crop production in the country.

After the symposium itself, those who were interested had the opportunity to visit different farms dedicated to vegetable crop production and were able to see what it's like to be a farmer in Central Brazil, one of the most advanced agricultural belts in the country.

Warley Marcos Nascimento

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Section Vine and Berry Fruits

First Int'l Workshop on Vineyard Mechanization and Grape and Wine Quality

The First International Workshop on Vineyard Mechanization and Grape and Wine Quality was organized by the Istituto di Frutti-Viticultura of the Agricultural Faculty of the Catholic University of the Sacred Heart under the aegis of ISHS and was held 27-29 June in Piacenza, Italy. In spite of the unpredictability associated with any "first edition" and the overlapping or closeness in time with several other grapevine meetings around the world, attendance reached 85 people, representative of 14 different countries. The more formal presentations were concentrated around four main sessions dealing with precision viticulture, mechanization of harvesting and spraying, mechanization of winter and summer pruning and mechanization systems, automation and economics. For each session, invited speakers were, respectively: Bruno Tisseyre (Supagro, France), Cesare Intrieri (Emeritus, University of Bologna, Italy), Nick Dokoozlian (Vice President of E & J Gallo Winery

• Visit to Omati Estate with technical machine demonstration. Background is the Val Tidone Valley, where mostly 'Barbera' and 'Croatina' are grown.





Participants of the Workshop

and Vice-Chair of the Vine and Berry Fruits ISHS Section, USA) and Daniel Newson (Yalumba Wine Company, Australia). Throughout the different sessions and in addition to the four invited lectures, a total of 25 orals were presented and the program was enriched with the display of 24 posters. Presentations were well

received by the audience as testified by the very lively debate occurring during the specific thirty minute discussion periods allotted at the end of each session. Availability of simultaneous translation from English into Italian facilitated interactions among participants and contributed to fruitful and stimulating discussions.

On Wednesday afternoon participants moved to the surrounding hills of the Omati Estate where a machine demonstration was organized. Two groups of similar size in number were formed (one with translation and the other without) and everyone was provided with earphones to ameliorate acoustics and listening



Dr. Stefano Poni and Maurizia Gentili awarded home-crafted paintings of the four major viticulture valleys of the Colli Piacentini Area, to Bruno Tisseyre (A), Cesare Intrieri (B), Nick Dokoozlian (C), Daniel Newson (D), Nicola Montesissa (E), the two interpreters (Federica and Roberta) (F) and Silvia Civardi (G).





■ Dr. Nick Dokoozlian, Vice Chair Section Vine and Berry Fruits (right), handing out an ISHS medal and certificate to Convener Dr. Stefano Poni (left).

in an environment disturbed by noise of different engines and tractors. Operating machines were provided by the following sponsors: New Holland, All-Vineyard, Bertoni, Nobili, SAME, Martignani, Tecnovict and Casella. Operations included soil tillage, grass mowing, shoot trimming, spraying and variable rate technologies applied for leaf removal and fertilization. Live machine runs along rows raised a lot of interest, questions and interactions between participants and machine staff.

On Wednesday night, the social dinner took place at the Montesissa Estate in view of a beautiful sunset in the background. During a dinner break and in front of the cake bearing the logos of both Catholic University and ISHS, the Convener Dr. Stefano Poni awarded the four invited speakers, Nicola Montesissa, the interpreters, and Silvia Civardi as representative of the Organizing Committee, with beautiful home-crafted paintings of the four major viticulture valleys of the Colli Piacentini area made with colors actually extracted from the berry skins of different cultivars (artist was Ms. Maurizia Gentili).

While not recalling earlier ISHS symposia in the field, the challenge to run a workshop putting together solely mechanical issues with maintenance of grape and wine quality in the vineyard, proved to be a winning formula. The level of the presentations was extremely high and the following discussions were animated. Participants came to the consensus that reliable and highly performing vineyard machinery is available on the market and that, economically speaking, costs can be considerably reduced when compared to manual interventions. Much less clear, and certainly debatable, is the impact of mechanization on wine quality. The topic is of paramount importance since all major viticultural regions are facing problems of either increasing costs and/or decreasing availability of manual labor (especially for vineyard operations requiring skilled workers such as winter pruning) and, at the same time, staying competitive "on the global market" without impairing

grape composition and wine quality, a non-negotiable standard.

Among the different topics discussed and in terms of innovation presented during the workshop, two major milestones were reached. On the one hand, all agree that there is increasing interest in precision viticulture (PV) techniques (about 20% of the oral presentations dealt with this matter) with a lot of discussion centering on the best spatial resolution of the images (airborne vs. proximal sensing), as well as cost/benefit analyses vs. traditional vineyard management. On the other hand, researchers agree that grape quality is maintained, or even improved, in mechanized vineyards as compared to traditional ones, provided the best integration between machine and trellis-training systems is achieved.

The location of the 2nd International ISHS Workshop on Vineyard Mechanization and Grape and Wine Quality will take place in 2015, in New York, USA.

Stefano Poni

CONTACT

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Commission Horticultural Engineering First Int'l Symposium on Computational Fluid Dynamics (CFD) Applications in Agriculture

The First International Symposium on Computational Fluid Dynamics (CFD) Applications in Agriculture was held at the Valencia Conference Centre in Valencia, Spain, during July 9-10, 2012. This symposium ran in parallel with CIGR-AgEng2012 International Conference of Agricultural Engineering. It was organized by the CFD Working Group of the ISHS Commission Horticultural Engineering and it was supported and endorsed by the Technical Section II (Structures and Environment) of the International Commission of Agricultural and Biosystems Engineering (CIGR), and the Section of Environment of Plant Structures of the American Society of Agricultural and Biological Engineers (ASABE). This first symposium

devoted to CFD Applications in Agriculture was sponsored and received financial support from ANSYS Spain as well as the Spanish National Institute for Agricultural Research (Instituto Nacional de Investigaciones Agrarias y Agroalimentarias, INIA). A total of 62 papers (2 keynote, 38 oral and 22 posters) were presented from more than 75 submitted. More than 70 participants from 25 countries from all continents attended the symposium.

Computational Fluid Dynamics (CFD) has become very popular in engineering fields including agriculture. The range of applications is broad and encompasses many different fluid phenomena. CFD is nowadays a mature modeling and simulation tool, and it is considered

robust and reliable. Many researchers have adopted this approach to study heat, ventilation and air condition (HVAC) of agricultural buildings such as greenhouses, livestock houses and storages, but also to study atmospheric dispersion of odors, emissions and pesticide spraying drift, and to optimize production systems of renewable energy. So CFD is now commonly used in the field of agriculture. However, CFD practitioners in the agriculture engineering field are widely spread, and usually present their work and results in different, application focussed international forums and conferences. Hence, this symposium was a first attempt to initiate discussions on the CFD technique applied to agriculture engineering. The main



● Dr. Murat Kacira, Vice Chair of ISHS Commission Horticultural Engineering (left), awarding the ISHS medal and certificate to Dr. Ricardo Suay Cortés, Symposium Convener (right).



● CFD Working Group meeting chaired by Dr. In-Bok Lee, Chair of the Working Group, and Dr. Murat Kacira, Vice Chair of ISHS Commission Horticultural Engineering.

objective of the symposium was to provide the opportunity to share research experiences and to promote networking among CFD practitioners in the field of agriculture.

The Convener, Dr. Ricardo Suay from the Institute of Agricultural Research of Valencia (IVIA), opened the meeting and keynote speaker, Dr. In-Bok Lee, gave a historical perspective of CFD applications in agriculture: overview and summary of the trends of 30 years of publications about CFD and agriculture. The second day, keynote speaker Dr. Philippe Geuziane placed special emphasis on quality and trust in CFD: how ERCOFTAC promotes and contributes to quality and trust in CFD applications in the industry sector.

The main topics covered were Food Engineering and Processing (1 session and 4 presentations), Machine Design and Performance (2 sessions and 11 presentations), Indoor Aerolics (3 sessions and 15 presentations) and Environmental Aerolics and Hydraulics (1 session and 6 and 2 presentations, respectively). There were two poster sessions with 22 posters that also covered the topics aforementioned.

The meeting of the CFD Working Group of the ISHS Commission Horticultural Engineering (CMEN) was held on Monday afternoon. The agenda started with the welcome by the Convener, the Chairman of the CFD Working Group (Dr. In-Bok Lee) and the Vice Chair of the Commission CMEN (Dr. Murat Kacira). The meeting ran through the planned agenda and included various topics. First, the Working Group and Commission were briefly introduced, and the last group meeting minutes of Greensys

2011 were approved. The Convener reported on the symposium main figures and scientific organization and Dr. Bartzanas informed the audience about coauthored manuscripts to be submitted to peer-review journals and gave updated information about the planned CFD technical sessions in the next Greensys 2013 symposium to be held in South Korea. Dr. Lee brought up-to-date information on the status of the web-based platform for the CFD Working Group. Dr. Norton presented and initiated a discussion on possibilities of EU funding of collaborative projects. Lastly, the Chairman Dr. Lee invited everybody to join and participate in the CFD Working Group, in the web-based CFD platform and in the next Greensys symposium.

The main contributions of the symposium were to create a discussion forum around the CFD technique as applied to agricultural engineering, to provide the opportunity of getting in touch with researchers in all fields of agricultural engineering from the five continents who use the CFD technique and face similar difficulties and share parallel experiences related to the technique; and finally, to promote networking among the CFD practitioners who for the very first time have shared the floor of an international research event like this symposium. The main contribution is demonstrated by the success of this first symposium, in terms of participation, discussions and broadening of the topics covered.

The symposium demonstrated that CFD is a useful tool for agricultural engineering and that the range of applications is as wide as agricultural engineering itself. Every agricultural engineering application has the potential for using the CFD technique. The many different

and thorough applications showed that this technique can be considered almost mature in the field of agricultural engineering. Therefore, the time to go a step further has arrived, and a series of symposia focussed on CFD has a large potential for growth.

In current times when expensive experimental work is so often unaffordable, CFD allows for a systematic study of scenarios and cases with limited experiments or even based on model validations of similar published cases. Computer capacity is always growing, as will the quality and accuracy of CFD simulations, and also the scope and range of agricultural engineering applications. The problems that cannot be handled today will be solved tomorrow. In conclusion, CFD applications in agriculture (engineering) have a bright future.

Finally, we would like to thank the CIGR-AGENG 2012 International Conference President, Dr. Florentino Juste, for the opportunity to hold this symposium under the auspices of this conference.

Ricardo Suay Cortés

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Int'l Conference & Exhibition on Soiless Culture



Participants of the conference.

The International Conference & Exhibition on Soiless Culture was held from May 22-26, 2012 in Shanghai, China. The conference was organized by the Shanghai Academy of Agricultural Sciences, and under the auspices of the International Society for Horticultural Science (ISHS) and its Commission Plant Substrates and Soiless Culture. It was sponsored by several local hydroponic companies such as Shanghai Sunqiao Agricultural Technology Co., Ltd. Over 120 participants from 16 countries

attended this conference. Participants included researchers, hydroponic equipment suppliers, consultants, and extension personnel from the government department. The conference provided the opportunity for all participants to exchange and discuss the current situation, trends, and new achievements on topics of modern hydroponics, plant nutrition, growing media, and plant physiology, focusing on the theme of "modern hydroponics and soiless culture for a better life".

One of the highlights of this conference was that many presentations focused on the promising future of soiless culture for improving life quality, especially in cities. For example, Prof. Dr. W.H. Schnitzler from Germany, presented a stimulating keynote presentation entitled "Urban hydroponics is mainstream for the city environment and for food security". With the rapid expansion of cities, feeding citizens with fresh and safe produce is becoming a problem worldwide. According to the presentation of

Keynote presentation by Dr. W.H. Schnitzler.



Field trip to Zhuanghang Experimental Station.



Prof. Dr. Toyoki Kozai from Chiba University, Japan, plant factories making ample use of soilless culture will definitely be adopted and will be a good choice. He specifically indicated that 102 plant factories with artificial light for commercial production of leaf vegetables are already in operation as of March 2012. Dr. Jie He from Singapore, shared their achievements in aeroponically growing vegetables in the city. Another project presented by Prof. Savidov, made use of aquaponics, a type of plant factory system that made urban agriculture more sustainable. Finally, Prof. F.G. Schroeder shared the achievements of his laboratory working on greenhouse modules in planetary habitats. Hydroponics has always been pursued as a possible solution to growing plants in space.

Another highlight of this conference was the opportunity for many Chinese scientists to present their work and exchange their most recent results on soilless culture. Prof. Dr. Weijie Jiang updated delegates on recent advances of soilless culture in mainland China. He reported that the area of soilless culture has increased from 0.1 ha in 1985 to 5200 ha in 2011. This

is outstanding growth, but is still insignificant compared to its proportion of greenhouse acreage (less than 0.1%).

Mr. Xiaoyun Wang, chief agronomist of the Beijing Lüdong Guochuang Agriculture Sci. & Tech. Co., Ltd, demonstrated their new patented soilless culture facilities. Their exhibit attracted the attention of many overseas delegates. It was obvious that there is a large amount of innovative R&D being conducted in soilless culture in China.

Several field trips were organized to present the R&D, demonstration, and production situation of soilless culture in China. After visiting the offices and research facilities of the Shanghai Academy of Agricultural Sciences, participants were given an overview of China's soilless culture development. Clearly, despite abundant strides made in recent years, the country still has a long way to catch up with the advanced level in developed countries.

The organizers sincerely appreciate the sponsor's generosity and the participant's attendance that contributed to making this conference

a success. Particular thanks should be given to Prof. Mike Nichols from New Zealand and Ms. Christine Paul from Australia, who both wrote interesting reports from the symposium for an Australia professional magazine called "Practical Hydroponics and Greenhouses". Prof. Mike Nichols reviewed in detail the presentations and field excursions, while Ms. Christine Paul presented a more general review on the history and current situation of soilless culture in Shanghai, entitled "Soilless Science in Shanghai".

Qiansheng Li and Shuang Xu

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Commission Quality and Post Harvest Horticulture Seventh Int'l Postharvest Symposium (IPS 2012)



Participants at IPS 2012.



Malaysian cultural performance during the opening ceremony of IPS 2012.

The 7th International Postharvest Symposium (IPS 2012) was held between the 25th and the 29th June 2012 at Putra World Trade Centre (PWTC), Kuala Lumpur, Malaysia. It was organised jointly by the Malaysian Agricultural Research and Development Institute (MARDI) and the Universiti Putra Malaysia (UPM) under the auspices of the ISHS in cooperation with the Malaysian Department of Agriculture (DOA), the Federal Agricultural Marketing Authority (FAMA), the Malaysian Board of Farmers Association (LPP), the International

Tropical Fruits Network (TFNet), the Malaysia Convention and Exhibition Bureau (MyCEB), the Malaysia Pineapple Industry Board (MPIB), the Universiti Kebangsaan Malaysia (UKM), the University of Nottingham, Malaysia Airlines and Kuala Lumpur City Hall. The symposium, the first staged in Asia, was strongly supported by the Ministry of Agriculture and Agro-based Industries, the Ministry of High Education and Tourism Malaysia.

The theme selected for the symposium was "Postharvest for Wealth and Health". The sym-

posium was well attended by 436 registered participants from 48 countries. The opening ceremony, officially opened by the Honorable Malaysian Deputy Prime Minister, included welcoming speeches from the Director General of MARDI, Datuk Dr. Abd Shukor Abd Rahman and the Chair of the ISHS Commission Quality and Post Harvest Horticulture, Dr. Sirichai Kanlayanarat. During the opening ceremony, Prof. Adel Kader, USA, received an ISHS Special Recognition Award for his excellent contribution to global postharvest horticulture.





Prof. Adel Kader (3rd from left) receiving ISHS Recognition Award for excellent contributions to global postharvest horticulture from the Malaysian Deputy Prime Minister. Dr. Sirichai Kanlayanarat is on the extreme left.



Some of the participants being briefed at MARDI's Postharvest Complex in Serdang during one of the technical tours.

The programme comprised plenary sessions (4), concurrent oral sessions (12), poster sessions (2), workshops (4), exhibitions and technical tours. Thirty-four world renowned speakers delivered keynotes, lead papers and workshop presentations. There were 158 oral presentations and 214 posters displayed both as hardcopies and e-posters. The e-posters have been displayed on the website at <http://postharvest2012.mardi.gov.my/> for a specific period.

Over four days the plenary sessions addressed specific topics: "Postharvest for wealth and health", "New emerging technologies and postharvest sciences", "Bridging the gaps between postharvest technology", and "Strengthening global cooperation". The opening keynote address, which was of the same title as the theme, was presented by Dr. Shioh Y. Wang (USA). Other keynote presentations were on "New emerging technologies and postharvest sciences" (Dr. Pietro Tonutti, Italy), "Postharvest technology: Why, what and who for?" (Dr. Ron Wills, Australia) and "Opportunities for international collaboration in postharvest education and extension activities" (Dr. Adel Kader, USA). Five specially invited papers were presented during the plenary sessions to complement the respective keynote addresses, namely "Interdisciplinary team-work for providing global citizens with a safe, adequate and healthy diet" (Dr. Mark Failla, USA), "History, current situation and future prospects for dynamic controlled atmosphere (DCA) storage of fruits and vegetables" (Dr. Robert Prange, Canada), "Through the looking glass: Tomographic techniques for inspecting the secret inner life of fruit" (Dr. Bart Nicolai, Belgium), "Postharvest science as a tool for competitive advantage" (Dr. Julian Heyes, New Zealand) and "USAID's agricultural research strategy: The role of horticulture and postharvest losses" (Dr. John Bowman, USA).

There were 13 topics covered during the sym-

posium, namely Preharvest Effects (57 papers); Physiological and Molecular Mechanisms (19); Physical and Chemical Treatments (68); Postharvest Pests and Diseases (44); Antioxidants, Bioactive Compounds and Health (17); Low Temperature Storage (10); CA/MMA and Minimal Processing (32); Omics and Physiological Disorders (32); Engineering and Mechanisation (10); Quality, Safety and Security (16); Handling and Packaging (14); Consumers and Marketing (7); and Others (17). During the concurrent sessions, 134 oral papers were presented including eight lead papers on "Interaction between production characteristics and postharvest performance and practices for fresh fruits" by Dr. Daryl Joyce, Australia, "Aroma Biology of harvested fruit: Recent advances and lingering questions" (Dr. Randy Beaudry, USA), "Impact of postharvest technologies on the flavour of fresh produce" (Dr. Charles Forney, Canada), "Forensic market pathology: Tracking the pathogen, its origin and the inoculum sources in the supply chain" (Dr. Lise Korsten, South Africa), "Postharvest technology for young coconuts" (Dr. Jingtair Siriphanich, Thailand), "Aspects of quality, safety and security in relation to fruit and vegetable consumption" (Dr. Anna Snowdon, United Kingdom), "Resource mapping of fresh produce waste in the supply chain" (Dr. Leon Terry, United Kingdom), and "Consumer marketing in the new agri-food marketing system for fresh fruits and vegetables: Some evidence on the importance of quality" (Dr. Fatimah Arshad, Malaysia).

Four workshops focussed on the topics of "Postharvest Technologies in Developing Countries" (Organiser/Moderator: Dr. Yahia El-hadi, Mexico), "Managing Chilling Injury" (Dr. Chien Yi Wang, USA), "Antioxidants, Bioactive Compounds and Health Promoting Substances" (Dr. Angelos Kanellis, Greece) and "Emerging Technologies – From Concept to

Reality" (Dr. Errol Hewett, New Zealand). Four papers were delivered in each session by invited speakers and the moderator.

There were a total of four technical tours organised for the delegates on June 27, 2012. In the first tour, delegates had the opportunity to visit the MAS Cargo at Kuala Lumpur International Airport (KLIA), the Agriculture Heritage Park in Putrajaya and UPM at Serdang. The second tour involved visits to MARDI and the DOA's Phytosanitary Quarantine Centre both at Serdang and the Agriculture Heritage Park at Putrajaya. Delegates of the third tour had a quick glimpse of Malacca history after visiting the Agro Park at Sungai Udang. In the fourth tour, delegates visited Perdana Botanical Garden, Kuala Lumpur and the city. An interesting Fruit Fest was specially organised by FAMA one day earlier at the symposium site and all delegates were treated to delicious Malaysian fruits including durian, mangosteen, rambutan and dokong.

Most delegates expressed their satisfaction with the excellent conduct of IPS 2012 and considered the event to be very successful. During the ISHS business meeting, Mexico was selected as the host country of the 8th IPS to be held in 2016.

Hope to see you all in Mexico in 2016!

Abdullah Hassan, Tengku Abd Malik Tengku Maamun and Ramlah Md Isa

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Commission Sustainability through Integrated and Organic Horticulture

Second Int'l Organic Fruit Symposium



Participants of the symposium.

Organic Fruit 2012 – the Second International Organic Fruit Symposium was held in Leavenworth, Washington State, USA from 18-21 June 2012, in the heart of the organic tree fruit production region. Over 100 people attended from 15 countries on 4 continents. The symposium included oral and poster presentations covering the multidisciplinary nature of organic fruit, from horticulture, to soils and nutrition, to pest biocontrol and pathology, to economics, systems, and impacts. Both tree fruits and small fruits were represented in the scientific sessions. Many of the sessions were

also convened as live webinars by eOrganic <eorganic.info>.

The symposium opened with a welcome from Co-Conveners David Granatstein and Preston Andrews of Washington State University, and Robert Prange, Chair of the ISHS Commission on Sustainability through Integrated and Organic Horticulture. Howard Nager from Domex Superfresh Growers gave the opening lecture on the organic fruit market.

The first full day of scientific sessions began with an opening plenary of invited presentations on the current and future market for

organic fruit (Don Harris, US market and Franco Weibel, European situation), challenges of controlling plant diseases (Imre Holb), biological pest control (Nick Mills), and potential impacts of genetics, genomics and breeding on organic fruit production (Kate Evans). This was followed by presentations by researcher/grower pairs from USDA Organic Research and Education Initiative (OREI) projects representing strawberry, apple, and high tunnel production. The afternoon included oral sessions on insect biocontrol, horticulture and plant pathology, as well as the poster session.

On Wednesday a full day tour was organized by Co-Convenor Harold Ostenson. The first stop was the state-of-the-art apple and cherry sorting, grading and packing facilities of Stemilt Growers in Wenatchee. We then visited Washington State University's orchard research facility, where WSU scientists talked about their research on insect biocontrol, tree fruit breeding, apple replant disease, and organic weed control. Next stop was Mike Brownfield's family-owned, diversified organic farm near Chelan where we heard about the sustainability of organic fruit growing and viewed his diverse orchard and packing facility. This was the first organic farm certified in the state in 1988. At nearby Stormy Mountain Ranch, high above glacial Lake Chelan, Ray Fuller gave us a walking tour of his modern orchard of apples, cherries and pears, and explained how he takes advantage of elevation and microenvironment differences to ensure quality fruit production and extended harvest timing. At the final stop, high above the Columbia River, Kyle Mathison introduced his Stemilt Hill orchards of organic and conventional apples, cherries, and pears, showed us his compost facility which processes

An orchard visit on the tour.



Moreno Toselli discusses organic orchard floor management with David Granatstein and Julia Reekie during the poster session.



over a thousand tons of material a year, and discussed the advantages of using compost in both organic and conventional orchards. The tour concluded with a memorable gala dinner hosted by Kyle and Jan Mathison at their mountaintop home. The dinner included Pacific Northwest salmon, asparagus, wine and beer, and a sweet cherry desert.

The final day of the symposium began with a plenary session on soil management, followed by sessions on soils and nutrition, organic fruit systems, economics, and a panel discussion on global funding opportunities and the challenges of organic fruit research. At the business meeting after lunch, the group voted to form a Working Group for Organic Fruit with David Granatstein as Chair. It was decided that the next symposium will be organized by Dr. Stéphane Bellon and Dr. Sylvaine Simon in 2015 in France. The final afternoon was devoted to a plenary session on the impacts and progress of organic fruit, and a closing session that included presentations by session leaders, who summarized the presentations and lessons learned in their topic areas. There was strong consensus that soil biology is a topic needing much more research. This interactive session contributed to one of the main goals of the symposium – to foster constructive interactions and potential collaborations among attendees.

The Co-Conveners wish to acknowledge and thank the symposium's Planning Committee



• Kyle Mathison of Stemilt Growers describes the compost facility he has developed on his orchard.

and session leaders for their advice and assistance, the generous donations of numerous industry and government sponsors, the USDA Organic Research and Education Initiative for grant funding, and eOrganic for the webinars, which made many sessions available to

a worldwide audience. We also wish to thank the conference planner, on-site assistants, and the fiscal and administrative support of WSU's Center for Sustaining Agriculture and Natural Resources. We are grateful to all attendees for their enthusiasm and invaluable presentations, without which the symposium could not have been a success. Recorded presentations and the book of abstracts are available at <http://www.extension.org/pages/64359/2nd-international-organic-fruit-research-symposium> and <http://www.tfrec.wsu.edu/pdfs/P2535.pdf>.

Preston Andrews, David Granatstein and Harold Ostenson

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Harold Ostenson, Wenatchee, WA 98801, USA, email: hostenson@gmail.com



FROM THE SECRETARIAT

New ISHS Members

ISHS is pleased to welcome the following new members:

NEW INDIVIDUAL MEMBERS:

Australia: Rowan Berecny, Kent Fanning, Barry Feenstra, Ms. Lisa Martin, Mr. Simon Tran; **Belgium:** Pieter Jacobs, Mr. Frederik Leyns; **Brazil:** José Geraldo Brarboza, Tânia Ferreira, Dalbó Marco, Prof. Dr. José Eduardo Pinto, Paulo R. Simonetto; **Canada:** Michael Brownbridge, Louis Damm, Ms. Mary Fruci, Dr. Mark Lefsrud, David Llewellyn, Ashley McDonnell, Dr. Alan Scott, Michael Stasiak, Mr. Marc Theroux; **China:** Jianfeng Dai, Dr. Wenke Liu, Dr. Yifei Liu, Na Lu, Yan Ren; **Curacao:** Mr. dominico Martina; **Czech Republic:** Tomáš Necas, Ivo Ondrásek; **Denmark:** Niels Erik Andersson; **Egypt:** Eslam Elfadly, Dr. Shaymaa Hassan; **Finland:** Towe Backman; **France:** Miriam Colin Avila; **Germany:** Dr. Yvonne Klopotek, Thorsten Rocksch, Ms. Tamara Wenk; **Greece:**

Mr. Aristides Efstathiou; **Guatemala:** Francisco Viteri; **Iceland:** Dr. Christina Stadler; **India:** Prof. Dr. Kumar V; **Italy:** Dr. Valeria Cavallaro, Prof. Piero Fiorino; **Japan:** Ryosuke Endo, Dr. Fumio Fukuda, Yohei Higuchi, Dr. Kazuyoshi Kitazaki, Ms. Yasuyo Nishimura, Yoshiaki Sakai; **Korea (Republic of):** Mr. Don Baid, Myung-Min Oh, Kilsun Yoo, Dr. Hae Suk Yoon; **Latvia:** Gunars Lacis, Ilze Gravite; **Luxembourg:** Sebastien Billon, Stéphane Mouthuy; **Mexico:** Mr. Francisco Orduno; **Netherlands:** Marco Brok, Dr. Pieter De Visser, Jantineke Hofland-Zijlstr, Dr. Sander Hogewoning, Jan Janse, Dr. Wanne Kromdijk, Dennis Medema, Bertus Meijer, Mr. Sjoerd Mentink, Celine Nicole, Eugen Onac, Luc Stevens, Gert-Jan Swinkels, Marcel V. Twist, Mr. Jim Van Ruijven, Mary Warmenhoven; **New Zealand:** Mr. Lloyd Foss, Dr. Jason Wargent, Sue Willetts; **Nigeria:** Mr. Habu Saleh Hamisu; **Norway:** Suthaparan Aruppillai, Gunnar Larsen; **Oman:** Ms. Laila Al Yahyaee; **Peru:** Prof. Dr. Roberto Ponugal; **Poland:**

Dawid Bujalski, Miroslaw Sitarek; **Russian Federation:** Dr. Olga Avercheva, Dr. Tatjana Shibaeva; **Saudi Arabia:** Dr. Shahid Nawaz; **South Africa:** Queline Bersiks, Prof. Richard Hendrick, Prof. Hennie Stoffberg, Megan Taylor, Elize van Staden; **Spain:** Mr. Stewart Andres, Juan Carlos López Hernández, Dr. Juan Negueroles Perez, Mr. David Negueroles; **Sweden:** Ms. Ida Fällström, Staffan Hillberg, Helena Karlén; **United Kingdom:** Mr. Nick Arnst, Henriett Elek, Steve Jackson, Dr. Wagdy Sobehi, Mr. Wayne Sullivan; **United States of America:** Sarah Castro, Carlos Crisosto, Jason Fatten, Mr. Paul Fuhrmann, Dr. Mark Gaskell, Elaina Hanzel, Ms. Teresia Hazen, Mr. Evan Kutta, Dr. Mary Mancini, David Moreno, Franz Niederholzer, Dr. Cecilia Nunes, Gary Obenauf, Sonali Padhye, Mr. Rex Peterson, Nadav Ravid, Mr. Philip Sheridan, Dr. James Shrefler, Mr. Alberto Vanegas, Gerson Van'T Wout.

Calendar of ISHS Events

For updates and more log on to www.ishs.org/calendar. To claim the reduced registration for ISHS members make sure to mention your membership number when registering and ensure your ISHS membership is current. If in doubt: check your membership status online at www.ishs.org/directory/

YEAR 2012

■ February 24-26, 2013, Muscat (Oman): **International Conference on Agricultural Engineering: New Technologies for Sustainable Agricultural Production and Food Security.**

Info: Dr. Yaseen Al-Mulla, P.O. Box 34, 123 Muscat Al-Khoud, Oman. Phone: (968)24-141201, Fax: (968)24-413418, E-mail: yalmula@hotmail.com Web: <http://www.agengineeringconf.com/>

■ March 26-28, 2013, Chiang Mai (Thailand): **IX International Symposium on Temperate Zone Fruits in the Tropics and Subtropics.**

Info: Dr. Jirakorn Kosaisawe, Director General, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412 E-mail symposium: tzfts2013@yahoo.com Web: <http://www.ishs.org/calendar/TZFTS.pdf>

■ March 26, 2013, Dubai International Exhibition Centre (United Arab Emirates): **Middle East Horticultural Summit.**

Info: Mr. Richard Pavitt, Informa Inc., Office 20:01, Level 20, Sheikh Rashid Tower, Dubai, United Arab Emirates. Phone: (971)4 407 2606, E-mail: richard.pavitt@informa.com or Dr. Elke Gabriel Neumann, Assistant Professor, Chair, Department of Aridland Agriculture, College of Food and Agriculture, United Arab Emirates University, Al Ain, United Arab Emirates. Phone: (971)3713-4566, E-mail: elke_neumann@uaeu.ac.ae or Associate Professor Dr. David Aldous, 37 McCartney Street, Ormiston, QLD 4160, Australia. Phone: (61)07 3821 2082, E-mail: dealdous@gmail.com E-mail symposium: richard.pavitt@informa.com

■ April 21-26, 2013, Santiago (Chile): **IX International Symposium on Grapevine Physiology and Biotechnology.**

Info: Dr. Manuel Pinto, Instituto de Investigaciones Agropecuarias, Centro La Platina, Santa Rosa 11610, Santiago, Chile. Phone: (56) 27575164, Fax: (56) 27575164, E-mail: mpinto@inia.cl Web: <http://www.grapevine-chile2013.cl/en/>

■ April 29 - May 2, 2013, Kusadasi (Turkey): **II International Symposium on Discovery and Development of Innovative Strategies for Postharvest Disease Management.**

Info: Dr. Pervin Kinay, Ege University Faculty of Agriculture, Department of Plant Protection, 35100 Bornova IZMIR, Turkey. Phone: (90)232-388 4000, Fax: (90)232-374 48 48, E-mail: pervin.kinay@ege.edu.tr or Dr. Samir Droby, Aro, The Volcani Center, P.O.Box 6, 50250 Bet Dagan, Israel. E-mail: samird@volcani.agri.gov.il or Dr. Michael Wisniewski, Usda-Ars, 2217 Wiltshire Road, Kearneysville, WV 25430, United States of America. E-mail: michael.wisniewski@ars.usda.gov Web: <http://www.pdm2013.org>

■ May 27-31, 2013, Murcia (Spain): **VI International Symposium on Almonds and Pistachios.**

Info: Dr. Federico Dicenta, CEBAS-CSIC, PO Box 164, 30100 Espinardo (Murcia), Spain. Phone: (34)968 396 339, Fax: (34)968 396 213, E-mail: fdicenta@cebas.csic.es E-mail symposium: almond.pistachio.2013@cebas.csic.es Web: http://www.cebas.csic.es/almond_pistachio_2013/

■ June 2-7, 2013, Coimbra (Portugal): **VIII International Symposium on In Vitro Culture and Horticultural Breeding.**

Info: Prof. Dr. Jorge Canhoto, Department of Life Sciences, University of Coimbra, Arcos Do Jardim, Ap. 3046, 3001-401 Coimbra, Portugal. Phone: (351)239855210, Fax: (351)239855211, E-mail: jorgecan@ci.uc.pt E-mail symposium: IVCHB2013@uc.pt Web: <http://www.uc.pt/en/congressos/IVCHB2013/>

■ June 3-7, 2013, (Dominican Republic): **X International Mango Symposium.** Info: Juan Jose Espinal, Jose Amado Soler No. 50, Ensanche Paraiso, Santo Domingo, Dominican Republic. Phone: (1)809-5655603, Fax: (1)809-5444727, E-mail: jespinal@cedaf.org.do E-mail symposium: xmango2013@gmail.com Web: http://www.cedaf.org.do/eventos/xmango2013/en/index_en.html

■ June 3-7, 2013, Trani (Italy): **XI International Controlled and Modified Atmosphere Research Conference - CaMa2013.** Info: Dr. Giancarlo Colelli, Dip. Pr.I.M.E. Univ. Di Foggia, Via Napoli 25, 71100 Foggia, Italy. Phone: (39) 320 4394535, E-mail: g.colelli@unifg.it Web: <http://www.cama2013.org>

■ June 4-7, 2013, Gent (Belgium): **IX International Workshop on Sap Flow.** Info: Dr. Kathy Steppe, Laboratory of Plant Ecology, Ghent University, Coupure links 653, 9000 Ghent, Belgium.

Phone: (32)9-2646126, Fax: (32)9-2244410, E-mail: kathy.steppe@ugent.be E-mail symposium: secretariat@sapflowworkshop.info Web: <http://www.sapflowworkshop.info>

■ June 9-14, 2013, Columbia, Missouri (United States of America): **I International Symposium on Elderberry.**

Info: Mr. Andrew Thomas, Southwest Research Center, 14548 Highway H, Mt. Vernon, MO 65712, United States of America. Phone: (1)417-466-2148, Fax: (1)417-466-2109, E-mail: thomasal@missouri.edu Web: <http://muconf.missouri.edu/elderberrysymposium>

■ June 13-16, 2013, (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 Web: <http://www.mulberry2012.org>

■ June 17-19, 2013, Montreal, Quebec (Canada): **International Symposium on Medicinal Plants and Natural Products.**

Info: Dr. Jalal Ghaemghami, PO Box 320172, West Roxbury, MA 02132, United States of America. Phone: (1)3393686838, Fax: (1)3393686838, E-mail: jalal@shmen.org or Prof. Dr. Alain Cuerrier, 4101, rue Sherbrooke Est, Montréal Québec, Canada. E-mail: alain_cuerrier@ville.montreal.qc.ca E-mail symposium: antigua-ishs@shmen.org Web: <http://www.montrealishs.org>

■ June 17-20, 2013, Matera (Italy): **VIII International Peach Symposium.**

Info: Prof. Cristos Xiloyannis, Dip. Scienze dei Sistemi Colt., For., Amb., Viale dell'Ateneo Lucano, 10, 85100 Potenza, Italy. Phone: (39)3293606262, Fax: (39)0971205378, E-mail: cristos.xiloyannis@unibas.it or Prof. Dr. Paolo Inglese, Department DEMETRA, Università degli Studi di Palermo, Viale delle Scienze, ED. 4, 90142 Palermo, Italy. Phone: (39)09123861234, Fax: (39)09123860820, E-mail: paolo.inglese@unipa.it Web: <http://www.unibas.it/peach2013/home.html>

■ June 17-21, 2013, Leiden (Netherlands): **International Symposium on Growing Media and Soilless Cultivation.**

Info: Erik Van Os, Aan de Rijn 2, 6701 PB Wageningen, Netherlands. Phone: (31)317483335, Fax: (31)317425670, E-mail: erik.vanos@wur.nl or Wim Voogt, Violierenweg 1, 2665MV Bleiswijk, Netherlands. Phone: (31)174 485687, E-mail: wim.voogt@wur.nl or Mr. Chris Blok, Wageningen UR Greenhouse Horticulture, Violierenweg 1, 2665 MV, Bleiswijk, Netherlands. Phone: (31)317485606, E-mail: chris.blok@wur.nl E-mail symposium: Groschi2013.symposium@wur.nl Web: <http://www.groschi2013.wur.nl/>

■ June 23-27, 2013, Plasencia (Spain): **VII International Cherry Symposium.**

Info: Dr. Margarita López Corrales, SIDT, Finca La Orden, Guadajira, 06187 Badajoz, Spain. E-mail: margarita.lopez@juntaextremadura.net or Manuel Serradilla Sanchez, Centro Invest.



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- June 24-27, 2013, Orlando, Florida (United States of America):

IV International Symposium on Tomato Diseases: Economically, Environmentally, and Socially Sustainable Tomato Disease Management. Info: Ass. Prof. Mathews L. Paret, Plant Pathology Department, North Florida Research and Education Center, University of Florida, 155 Research Road, Quincy Florida FL-32351, United States of America. E-mail: paret@ufl.edu Web: <http://nfrec.ifas.ufl.edu/4istd/index.shtml>

- July 1-5, 2013, St. Augustine (Trinidad and Tobago):

NEW III International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions. Info: Dr. Majeed Mohammed, 22 Pine Drive, Homeland Gardens, Cunupia, Trinidad and Tobago. Phone: (1)868-671-2332, Fax: (1)868-645-0479, E-mail: mohd2332@hotmail.com E-mail symposium: ISHS.PostHarvest2013@sta.uwi.edu Web: <http://sta.uwi.edu/conferences/13/postharvest/index.asp>

NEW July 2-5, 2013, Zürich (Switzerland): XIII International Workshop on Fire Blight. Info: Dr. Brion Duffy, Agroscope Changins-Wädenswil, Schloss 1, Postfach, 8820 Wädenswil, Switzerland. Phone: (41)447836111, Fax: (41)447836341, E-mail: brion.duffy@acw.admin.ch E-mail symposium: fireblight2013@agroscope.admin.ch Web: <http://www.fireblight2013.org>

- July 15-19, 2013, Beijing (China): **VI International Symposium on the Taxonomy of Cultivated Plants.** Info: Prof. Zhang Qixiang, Nat'l Engineering Res.Center Floriculture, Beijing Forestry University, No.35, Qinghua East Road-Haidian Dist., Beijing 100083, China. Phone: (86)1062338005, Fax: (86)1062336321, E-mail: zqx@bjfu.edu.cn or Dr. Xiaobai Jin, Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun, Xiangshan, 100093 Beijing, China. Phone: (86)1062591431, Fax: (86)1062590348, E-mail: jinxiaobai@hotmail.com E-mail symposium: istcp2013@gmail.com Web: <http://www.istcp2013.org>

- July 17-20, 2013, College Station, TX (United States of America): **I International Symposium on Pecans and Other Carya in Indigenous and Managed Systems.** Info: Dr. L.J. Grauke, USDA ARS, Pecan Breeding & Genetics, 10200 FM 50 Rd., Somerville, TX 77879-5764, United States of America. Phone: (1)979-272-1402, Fax: (1)979-272-1401, E-mail: lj.grauke@ars.usda.gov or Dr. Leonardo Lombardini, Department of Horticultural Sciences, Texas A&M University, College Station, TX 77843-2133, United States of America. Phone: (1)9794588079, Fax: (1)9798450627, E-mail: l-lombardini@tamu.edu

- July 20-23, 2013, Taiyuan, Shanxi Province (China): **VII International Walnut Symposium.** Info: Prof. Jianbao Tian, Pomology Institute of Shanxi, Academy of Agricultural Sciences, Shanxi, Taigu, 030815, China. Phone: (86)0351-7073034, Fax: (86)0354-6215001, E-mail: tianjb-001@163.com Web: http://www.iws2013.org/English/en_index.aspx

- July 28-31, 2013, Orlando, FL (United States of America): **XII International Symposium on Plant Bioregulators in Fruit Production.** Info: Dr. Steven McCartney, NCSU, 455 Research Drive, Mills River, NC 28759, United States of America. Phone: (1)8286843562x115, Fax: (1)8286848715, E-mail: steve_mcartney@ncsu.edu or Dr. Timothy Spann, University of Florida - IFAS, Citrus Research and Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850, United States of America. Phone: (1)8639561151, Fax: (1)8639564631, E-mail: spann@ufl.edu

- **NEW August 5-8, 2013, Pattaya (Thailand): I International Symposium on Tropical and Subtropical Ornamentals.** Info: Dr. Mantana Buanong, Division of Postharvest Technology, School of Bioresource and Technology, King Mongkut's Univ. of Technology Thonburi, Bangmod, Bangkok 10140, Thailand. E-mail: mantana.bua@kmutt.ac.th E-mail symposium: tsto2013@kmutt.ac.th Web: <http://www.kmutt.ac.th/TSTO2013/>

- **NEW August 11-14, 2013, Fort Collins, Colorado (United States of America): II International Symposium on Plant Cryopreservation.** Info: Dr. Steve Wallner, Colorado State University, Dept of Hort LA CSU, Ft. Collins CO, 80525-1173, United States of America. E-mail: swallner@colostate.edu or Dr. David Ellis, International Potato Center, CIP, Avenida La Molina 1895, Lima, Peru. Phone: (51)13175337x3056, Fax: (51)13175326, E-mail: d.ellis@cgiar.org or Dr. Maria M. Jenderek, USDA-ARS, NCGRP, 1111 S. Mason Street, Fort Collins, CO 80521, United States of America. Phone: (1)970 495 3256, Fax: (1)970 221 1427, E-mail: maria.jenderek@ars.usda.gov Web: <http://col.st/RIETRA>

- August 19-21, 2013, Portland, OR (United States of America): **I International Symposium on Marketing and Consumer Research in Horticulture.** Info: Dr. Jennifer Dennis, 625 Agriculture Mall Dr., 320 Horticulture Building, West Lafayette, IN 47906, United States of America. Phone: (1) 765-494-1352, Fax: (1) 765-494-0391, E-mail: jhdennis@purdue.edu E-mail symposium: tgoodale@purdue.edu Web: <http://www.hort.purdue.edu/fruitveg/events/ismcrh1announce.pdf>

- August 25-30, 2013, Hannover (Germany): **VI International Symposium on Rose Research and Cultivation.** Info: Prof. Dr. Thomas Debener, Leibniz University of Hannover, Institute for Plant Genetics, Herrenhäuser Straße 2, 30419 Hannover, Germany. Phone: (49)5117622672, Fax: (49)5117629292, E-mail: debener@genetik.uni-hannover.de E-mail symposium: roses2013@genetik.uni-hannover.de Web: <http://www.rosesymposium2013.uni-hannover.de/>

- August 28-30, 2013, Villenave d'Ornon, Bordeaux (France): **VI International Phylloxera Symposium.** Info: Nathalie Ollat, INRA, Institut des Sciences de la Vigne et du Vin, 210, chemin de Leyssotte, 33883 Villenave d'Ornon, France. Phone: (33)557575930, Fax: (33)557575903, E-mail: ollat@bordeaux.inra.fr

- September 1-3, 2013, Sicily (Italy): **V International Symposium on Fig.** Info: Prof. Tiziano Caruso, Dipartimento DEMETRA, Univ.degli Studi di Palermo, Viale delle Scienze, Edificio 4 ingresso H, 90128 Palermo, Italy. Phone: (39)0916521100, Fax: (39)0916521098, E-mail: tiziano.caruso@unipa.it

- **NEW September 2-6, 2013, Queretaro (Mexico): 59th Annual Meeting of Interamerican Society for Tropical Horticulture.** Info: Dr. Carlos Alberto Núñez Colín, Inst. Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), KM 6,5 Carretera Celaya-San Miguel de Allende, Aprdo postal 112, Guanajuato, Celaya, 38110, Mexico. Phone: (52)4616115323x113, E-mail: nunez.carlos@inifap.gob.mx E-mail symposium: lixam2013@iasth.org

- September 2-5, 2013, Cranfield (United Kingdom): **VI International Conference on Managing Quality in Chains MQIC2013.** Info: Prof. Dr. Leon Terry, Plant Science Laboratory, Cranfield University, Bedfordshire, MK43 0AL, United Kingdom. Phone: (44) 7500766490, Fax: (44) 1525 863277, E-mail: l.a.terry@cranfield.ac.uk E-mail symposium: mquic-2013@cranfield.ac.uk E-mail abstract/paper submission: mquic-editor@cranfield.ac.uk Web: <http://www.mquic2013.com>

- **NEW September 2-5, 2013, Cuzco (Peru): International Symposium on Medicinal Plants and Natural Products.** Info: Dr. Jalal Ghaemghami, PO Box 320172, West Roxbury, MA 02132, United States of America. Phone: (1)3393686838, Fax: (1)3393686838, E-mail: jalal@shmen.org or Prof. Dr. Roberto Ponugal, Universidad Global Peru, Av. Camina Real L126, Urb. Quispicanchis, Cuzco, Peru. E-mail: antigua-ishs@shmen.org Web: <http://www.peruishs.org>

■ September 3-6, 2013, Olomouc (Czech Republic): **II International Symposium on Plum Pox Virus**. Info: Dr. Milan Navratil, Dept of Cell Biology and Genetics, Faculty of Science, Palacký University, Slechtitelu 11, 78371 Olomouc, Czech Republic. Phone: (420)685227646, Fax: (420)685221357, E-mail: milan.navratil@upol.cz Web: <http://www.isppv2013.upol.cz>

■ September 9-13, 2013, Naivasha (Kenya): **I International Symposium on Ornamentals in Africa**. Info: Dr. Arnold Opiyo, Horticultural Association of Kenya (HAK), PO Box 562, 20100 Nakuru, Kenya. Phone: (254)723119044, Fax: (254)512111113, E-mail: aopiyo@hotmail.com Web: <http://hakenya.net/index.php/ishs-symposium>

For updates logon to www.ishs.org/calendar



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