# Chronica Horticulturae

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ISHS

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# CHRONICA HORTICULTURAE

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**Cover photograph: Produce Seller 1567 by Pieter Aertsen showing various vegetables including purple and orange carrots and parsnips. See article p.13.**

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ISHS

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# Promote Horticulture and Horticultural Science

**Errol W. Hewett, Secretary of the ISHS Board, Responsible for Innovation, Industry and Insight**

Errol W. Hewett

We are all members of a prestigious international society. We are more than 8000 members from more than 150 countries. We all believe implicitly that our knowledge, skills and experience should be used in furthering the health, wealth, nutrition and wellness of human kind. In doing this we work with a huge and most amazing diversity of fruit, vegetables, flowers and ornamental plants.

## IMPORTANCE OF HORTICULTURE

Many of the fruit and vegetables we eat are visually exciting and sensually appealing with their range of colours and tactile sensations. They provide essential chemicals required by humans for health and vitality. The critical nutritional importance of fruit and vegetables for provision of essential components, including vitamins B and C, phytochemicals and fibre in our diet, is resulting in increasing linkages between our plant and food scientists and those in the medical profession. Joint international symposia are increasing between these sciences where topics of mutual interest are explored and new insights divulged.

We are becoming more aware of the economic and social significance of public gardens, parks, reserves, urban and peri-urban gardens, as well as the green areas of towns and cities. It has been estimated that internationally the value of the amenity or landscape industries to society is about 1% of gross domestic product or GDP (Haydu et al., 2008). This estimate does not include the beneficial effects on the human spirit and psyche through therapeutic benefits including de-stressing, as well as an increased 12% in productivity of workers in offices containing plants.

Underpinning this important horticulture sector is a wide and diverse scientific and technical base. Not only do horticulturists create new cultivars, but they apply innovative high tech production, postharvest and supply chain practices and processes. They develop wonderful and educational botanic gardens. Such accomplishments require committed individuals who are well trained in a cross section of contributory disciplines that make the complex science of horticulture.

During communication with distinguished leaders [Past Presidents of ASHS] in Horticultural Science Professor John Clark (2011) received the following comments:

***James Moore:*** *"Horticulturists were struggling for their identity. They were not considered on the same plane as agronomists working on the major agronomic crops. Now, that situation has changed.* ***Horticulture is now recognized as a major contributor to food for the benefit of humankind!*** *Never before has horticulture had more opportunities to contribute to the betterment of society and never before has society been as conscious of the health aspects of food and the quality of the environment."*

***Fred Bliss:*** *"Two areas seem to me to have particular opportunities for horticulture: first, the contributions of fruit and vegetables to a balanced healthy diet that will impact people globally. We have to change the mindset of leaders that it is only calories that count toward food security. Second the contributions that our horticultural plants are having to a truly green landscape whether urban, suburban, or rural. The contributions to beauty and comfort of surroundings should be prime for our horticultural plants."*

As ISHS members we must take advantage of the opportunities offered by these cogent comments. Each of us has a responsibility to become an advocate for our profession at all levels in our respective professional and personal communities. We must unite with other agencies that promote and encourage participation in diverse horticultural activities within our environment.

At a time when research funds for horticultural research are shrinking, when enrolments of first year horticultural students are declining in many countries, and when horticultural science departments are being subsumed into larger nebulous non-descript departments, many of our members are most concerned about continued existence much less trying to halt and reverse such trends.

Is this worrying trend because the public at large do not know what we do, what we stand for, or what our science contributes to nutritious food, human health and well being, and to economic resilience in rural and urban communities? If so, then we as a profession must work hard to change public perception of the value and importance of horticulture.

During the IHC2010 in Lisbon, a workshop on "Advocacy for Horticulture" was coordinated by Jill Stanley and attended by more than 30 participants. Outputs from the Workshop included recommendations on the need for:

- Branding: Prepare an international Facts and Figures booklet on the value of the horticultural industry.
- Prepare a communication and marketing plan to improve the general awareness and image of horticulture and horticultural science.
- Partner with people and organisations who can advocate for us.
- Promote Horticultural Science activities.
- Utilise the passion from the Ad Hoc Committee arising from the Workshop.

The Board is committed to implementing these recommendations. it is critically important that we take our message to the wider public, to policy and decision makers in Governments and in international and national organizations and agencies, to administrators in universities and other tertiary institutions, in particular those involved in funding education, R&D and international assistance.

To this end the Board has approved the preparation of an International Facts and Figures booklet on Horticulture that should be available on line by the end of 2011. In addition the Board has established an Ad Hoc Committee to further develop the recommendations of the Lisbon Workshop. It is probable that all ISHS members will be further consulted for their opinions on how to promote the Horticultural Science brand. All suggestions will be welcome and can be sent to me at ewmrhewett@xtra.co.nz.

## HORTICULTURAL INDUSTRY LINKAGES

It is important that ISHS membership embraces the entire spectrum of horticulture. Horticultural science is not the sole domain of the profes-

sional scientist. Outcomes from research are of no value unless they are passed on to end-users. There is a broad community of people not in scientific or public research institutions who play a critical role in ensuring that the information generated from research is utilized by all sectors across the supply chain.

Current membership of ISHS stands at about 8,000, the majority of whom are individuals with professional qualifications working on aspects of the production, postharvest, economic or aesthetic value of horticultural crops worldwide. Regrettably the Society has relatively few members from the horticultural industry despite their being integral participants to the successful acceptance and adoption of new information and technologies generated by R&D. It is not that the private sector is uninterested in our activities; in fact more than 30% of registrants at many of our Symposia are from the private sector. However industry representatives are under represented in actual membership numbers.

Why is this? Is it because we are not providing the required opportunities and activities for industry personnel to join ISHS? Is there no perceived value for industry people to join and participate in ISHS activities? Are ISHS activities too narrow and not meeting industry needs? Do we know what industry would like ISHS to provide? Do we not provide value for money?

It is the intention of the Board to reach out to the private sector to encourage closer and more meaningful relationships to develop than have hitherto existed. To this end an Industry Advisory Task Force has been appointed and charged with the responsibility of recommending actions that the Board might take in the future to increase membership of ISHS by making the organization more attractive and valuable to the horticultural industry sector. The Task Force will be a forum for communication and interaction among people from different backgrounds and professions from around the world who will focus on ways to develop and enhance the involvement between the horticultural industry and ISHS.

This Task Force will comprise very experienced individuals, committed to horticulture, who work in both the private and public sector with roles in production, grower liaison, research and development, extension/outreach, innovation, marketing, information transfer and education. Their focus will be to recommend ways in which the ISHS can develop closer more productive links with the horticultural industries, with a view to enhancing value to all parties.

Members are welcome to contribute their views and perspectives to this topic and can do so by emailing me at ewmrhewett@xtra.co.nz.

In conclusion, the current Board is determined to enhance communication with the Council, National Societies and current and prospective members. The creation of the two committees indicated above, together with the newly appointed Publications Committee by Yves Desjardins, will seek input from all members on how to enhance ISHS services and benefits to members. We will send out a survey to all members within the following few months, to obtain opinion and seek your advice about how to continue to keep the ISHS a successful, international professional body. We need to better represent the interests of all of us working in the horticultural science, food, fashion, nutrition and human well-being sectors.

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## JAPANESE TRAGEDY

The world was shocked and dismayed to learn of the enormous earthquake and subsequent tsunami that occurred near Sendai, Japan on 11 March 2011.

On behalf of all the ISHS membership, the Board and Secretariat send our sympathy to all our Japanese friends and colleagues, and all Japanese people who have been affected by this catastrophic disaster. We were all dismayed and horrified to witness on TV the speed and savagery of the after effects of this huge earthquake and subsequent devastation of the tsunami.

Our thoughts and prayers go out to all the families and friends affected by this tragic event. Our special condolences and best wishes go to Professor Koki Kanahama, President of the Japanese Society for Horticultural Science, and his colleagues who live and work in the affected areas, and to Professors Ikuo Kataoka and Ryutarou Tao, his colleagues on the ISHS Council.

We wish you well for speedy recovery back to normal lives and livelihoods. Japanese people have been heroic in the face of such a huge tragedy but the world knows that you have the courage and determination to return to normal life as soon as practicable.

# Food Fights

Cary Fowler

Every year, in a tradition dating to the 1940s, thousands gather in the Spanish town of Buñol in Valencia, for La Tomatina, a giant "food fight," in which participants gleefully pelt each other with tomatoes and get very, very messy. There's blood in the streets, but it belongs to the tomatoes.

However, according to a study in the prestigious journal *Science* (Büntgen et al., 2011) and two in the *Proceedings of the National Academy of Sciences*, we are about to experience food fights of a very different, more deadly type. One group of researchers (Zhang et al., 2007) examined the historic links between climate change and incidents of war in Europe and Asia. Going back a millennium, they uncovered a "strikingly high" correlation between temperature variation and the number of wars. Their explanation? Climate change has "significant direct effects on land-carrying capacity", which in turn "affects the food supply per capita." In their words, "the paths to those disasters operated through a reduction in agricultural production." As one might guess, these researchers, working from institutions in China, the US, and UK, found that the highest correlation between climate change and war occurred in arid regions, precisely the areas where food supplies were most vulnerable to climatic perturbations.

Another group of researchers, based at Berkeley, New York University, Harvard, and Stanford, focused on Africa (Burke et al., 2009). They too found "strong historical linkages between civil war and temperature…with warmer years leading to significant increases in the likelihood of war." What might we then expect to happen in Africa in the future? The researchers point out that: "When combined with climate model projections of future temperature trends, this historical response to temperature suggests a roughly 54% increase in armed conflict incidence by 2030, or an additional 393,000 battle deaths if future wars are as deadly as recent wars. Bear in mind that projected temperature increases for 2030 are a fraction of those predicted later in the century. One shudders to think how global peace and security will be affected then.

The point has not been lost on military leaders. In 2007, as food riots erupted in the state of West Bengal in India and over tortilla prices in Mexico, 11 retired US three- and four-star admirals and generals, including General Anthony Zinni, former Commander-in-Chief of the US Central Command, issued a report (Military Advisory Board, 2007) warning that climate change will be a "threat multiplier for instability in some of the most volatile regions of the world" and that it would "add to tensions even in stable regions…." In Africa these military leaders foresee climate change being an "incubator of civil strife, genocide and the growth of terrorism." In the Middle East, they state "the potential for escalating tensions, economic disruption, and armed conflict is great." And they believe that Asia "could be among the hardest hit regions."

Climate change causes agricultural problems that in turn give rise to hardship, hunger, unrest, and even war. Not a pretty picture. In this context it is hardly surprising that the US Central Intelligence Agency is establishing a new Center for the Study of Climate Change, or that the Pentagon now includes climate change among the security threats it assesses in its quadrennial defense reviews.

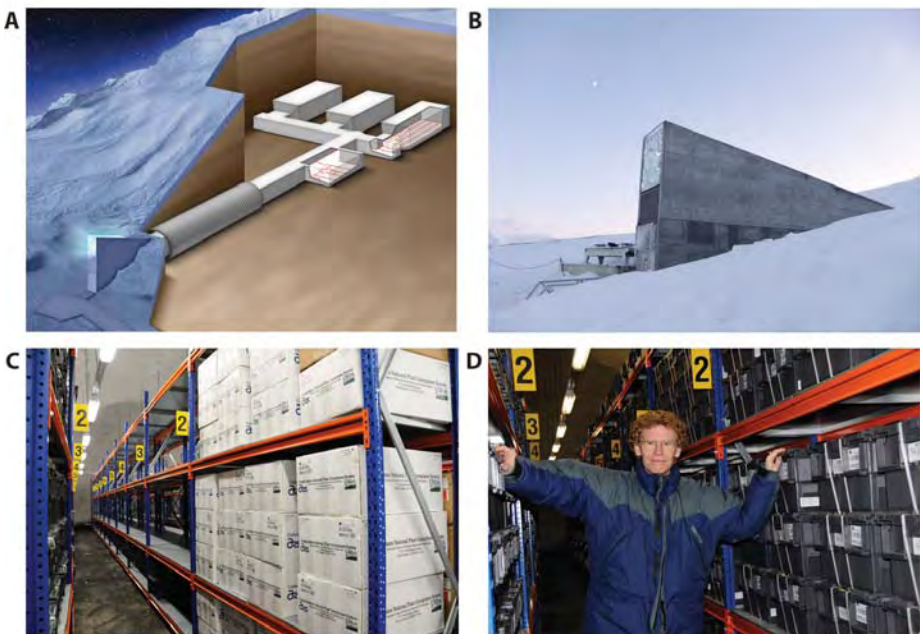
We need not rely solely on statistical correlations in academic papers to demonstrate the link between food and political insecurity. Just look back at 2007-2008, when the price of rice surged 200% and wheat and maize rose by more than 100%. Across the world, riots erupted and at least one government fell as a result. This year food prices have returned to record levels. The government of Tunisia has fallen, and Egypt is on the brink. In both cases, discontent over food issues has been part of the mix.

Now, two UK government departments are warning that global warming may cut India's farm output by a quarter (Foresight, 2011). Similar decreases in production of major staples have been predicted for Africa in the pages of the journal *Science*. Clearly climate change and security are fused together by the impact of climate change on food production. It is this link that will undermine global peace and security in the future. So, as General Zinni notes, we can act now, or "we will pay the price later in military terms. And that will involve human lives. There will be a human toll."

In other words, it should be a military priority to prepare agriculture for climate change. Yet this is only starting to register even as a development priority. Country after country and crop after crop, farmers will need new cultivars in the field that are adapted to the higher temperatures and to the new pests and diseases that will follow in their wake.

New cultivars are not possible without access to crop diversity. So if past is prologue, we need

**The Svalbard Global Seed Vault (popularly known as the Doomsday Vault): (A) Artist's illustration of the interior and exterior of the Svalbard Global Seed Vault; (B) seed vault entrance as seen at dusk; (C) aisle of seed shelves; (D) Cary Fowler, Executive Director of the Global Crop Diversity Trust, surrounded by shelves stacked with boxes of seeds.**



to be coming to grips with the fact that conserving the crop diversity necessary for increasing food production, particularly in a climate changing world, is a national security issue for all countries.

## SWORDS INTO PLOUGHSHARES?

In essence, General Zinni and his colleagues are saying that converting at least some swords into ploughshares to avoid future conflict makes good military sense. After all, even facing such a resolutely modern enemy as climate change, they are only echoing the 2,500-year-old advice of Sun Tzu, who wrote in *The Art of War* that supreme military excellence is not victory in battle, but winning without even fighting.

The good news is that this is a rare military expense that can be shared between all nations. Less than a half of one percent of the increase in global military spending between 2008 and 2009 would be sufficient to ensure the conservation and availability of crop diversity forever! Invested in an endowment it would generate sufficient income to maintain our most potent weapon in the fight to adapt agriculture to climate change – crop diversity.

Think of it this way: failure to sever the link between climate change and war represents a breach of security and a threat to peace. Failure to take easy steps to adapt agriculture to climate change is a failure to react to an avoidable threat that is strategically, and morally, unforgivable. An unmistakable message is coming from our early warning systems. If we ever intend to stop food fights, we'll have to conserve crop diversity, not just throw it at each other.

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## Horticultural Science Focus

# Intellectual Property: Defining Horticultural Assets and Implications for Horticultural Research and Development


**Geoffrey R. Dixon and John Ogier**



Securing horticultural research and development (R&D) by realising the financial value of intellectual property (IP) from horticultural assets is an imperative as public taxation-derived funding continuously falls.


Public tax-funded investment in horticultural research and development (R&D) is diminishing around the world, although some countries have yet to feel the full impact of this trend. By contrast, governments generally accept the need for public tax-derived support for 'blue-skies' curiosity-driven studies. Consequently, there is an increasingly large gap developing between provisions for basic and applied research. Applied research is being forced to accept the maxim that the 'user should pay', because there is no alternative. This stricture applies to many aspects of near-market R&D not solely to horticulture.

This economic policy may appear to run counter to the social, environmental and financial values of horticultural industries and their products. These were well identified by Mr. Jorge Sampaio's (previously, President of the Republic of Portugal (1996-2006) and currently United Nations High Representative for the Alliance of Civilisations) statements when opening the International Horticultural Congress in Lisbon, August 2010 (Dixon et al., 2011). Sampaio emphasised horticulture's roles as an economic engine and power for social good. He linked horticulture with the achievement of the United Nations' Millennium Goals. "Horticulture is well placed for aiding in the reduction of poverty and malnutrition" he asserted.

For the purposes of social good some public tax-raised investment may be deployed supporting research that increases the environmental, health and welfare benefits obtained from horticulture's products. But formulating efficient and cost-effective commercial production based on new science and technology is clearly now industry's task. Funding which converts applied research and especially development

into pre-competitive knowledge and industrial technology must come from enhanced product value and subsequent profits. The intellectual property on which developments are based therefore needs to be more carefully valued and safeguarded (Blakeney, 2009). Intellectual Property Rights (IPR) constitute assets from which future R&D both in research providers and industry itself may be funded. Horticultural scientists must become more adept at seeking returns on their knowledge and safeguarding investments in R&D.

## DEFINING AND PROTECTING INTELLECTUAL PROPERTY

Knowledge provides the basis for practices, processes and products which ultimately become Intellectual Property (IP). Ownership of rights to this property is a valuable financial asset. Private industry initially safeguarded its IP assets by secrecy. This is difficult to maintain because bringing a product or process to market often compromises secrecy and because of anti-trust legislation and arrangements for controlling cartels. The economic and social benefit of IP is that in return for public disclosure of an inventive step (as in the case of patents) a monopoly right is granted for a period of time. Disclosure stimulates further, possibly competing, research increasing returns for inventors. That recoups R&D costs and funds future research. In turn protecting IPR stimulates economic growth and investment (Bloomberg, 2005).

International agreements through the World Trade Organisation (WTO) and World Intellectual Property Organisation (WIPO, http://www.wipo.int/portal/index.html.en) provide the international standards for IPR. Legislation protects Intellectual Property Rights (IPR) securing global trade. The TRIPS (Trade Related Intellectual Property Rights) agreement signed in 1996 came from the General Agreement on Tariffs and Trade (GATT) negotiations on world trade and is fundamental for encouraging R&D in a global trading environment (http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm).

Horticulture, particularly in Western countries, while being highly adept at developing and using new knowledge and technologies has been painfully slow at realising asset value from its IP and developing protection. As a result fruits from R&D have migrated to least cost areas of production which have not borne past financial burdens of investment in R&D nor its future needs. Previously, an absence of financial returns from novel technologies flowing from horticultural R&D was of little concern for governments in developed countries. Governments funded research, built and staffed research institutes and development stations and freely disseminated the results through publically funded advisory services. If technology moved to least cost countries this was seen as assisting in keeping the price of food imported into developed countries low and aiding longer-term global economic progress. Now, steep reductions in government spending and the closure of publically funded services over the last 30 years have changed completely the economic landscape for Western horticultural research and industries.

Public organisations particularly those 'divorced' from government control and formed into non-governmental organisations (NGOs) have experienced cultural difficulties in formulating financially robust attitudes towards safeguarding their IPR. That has resulted in failures in gaining financial returns on R&D investments and resultant inabilities to renew facilities and employ new staff. Generally universities, particularly those with long established independence, have suffered less. Now both groups of research providers increasingly emphasise the importance of safeguarding IPR.

## THE PROTECTION OF HORTICULTURAL INTELLECTUAL PROPERTY

Plant breeding generates new cultivars. The genotypes used in their development are a strong, but not exclusive, source of horticultural IPR for research providers and private breeders protected by long standing international legislation (Agris, 1999). Genotype protection through Plant Variety Rights (PVRs) and associated Plant Patents are fundamentally important for horticulture although arguments that the legislation is too restrictive may have some validity (Ghijsen, 2009; Jonge, 2009). The international agreement which established Plant Breeders Rights (PBRs) is the International Convention for the Protection of New Varieties of Plants (UPOV Convention, http://upov.int). In North America and elsewhere new cultivars are patented and their properties published. It is the patent holder's responsibility to prove that infringement has taken place by establishing similarity. Some companies producing genetically modified (GM) cultivars introduce further biological or marketing protection preventing users from exploiting home-saved seed.

Much of horticultural research is about formulating specialised means of germinating, growing, fruiting and harvesting intensively grown crops for commercial, environmental or social profit. Commonplace husbandry systems are in the public domain and their scientific rationales are available in long-standing peer review publications like the *Journal of Horticultural Science and Biotechnology*, the *Journal of the American Society for Horticultural Science* or ISHS's *Acta Horticulturae* (www.ishs.org) series.

Now, however, national and multinational companies are developing and formulating formalised procedures for the breeding, propagation, production and marketing for particular crops and groups of crop. The documented knowledge becomes intellectual property requiring protection once the company licenses or franchises others to increase production or extend their geographical range. This intellectual property is a valuable asset identified in the company's accounts. This is happening in fruit (Hancock and Clark, 2009; Hinrichsen et al., 2009), vegetable and ornamental crops (Jørgensen, 2009). An example is the ornamental climber *Clematis* as developed by The Guernsey Clematis Nursery Ltd. and its Joint Venture Partner Poulsen®Roser A/S from Denmark, which supplies much of Europe and North America (Figs. 1-3).

Exploitation of IP is more often through the management of a portfolio of rights rather than a single right like PVR. For example, the Guernsey Clematis Nursery Ltd. also develops brand names for the marketing of cultivars which can receive trade mark protection. This is backed by the overall market brand of the owner Mr. R.J. Evison with an associated regis-

**Figure 1. New *Clematis* cultivar 'Rosemoor'.**

**Figure 2. *Clematis* breeding programme.**

**Figure 3. *Clematis* roots washed for export.**

**Figure 5. *Rosa*, a genus well protected by Breeders Rights.**


tered trade mark, copyright in books, pictures and trade secrets for the company processes for production which are linked to business partners in the international chain (Fig. 4).

Where the registration of rights is required it is important to identify for which markets protection is needed from competitors either to protect cultivar propagation or for brand protection through trademarks. Advanced horticulture companies have extensive databases capable of being afforded database protection and many will utilise software generally protected by copyright.

The collection of royalties from market sales of protected cultivars along with the licensing of producer nurseries under contract can provide further income streams to fund on-going investment in future internal or external R&D programmes (Fig. 5).

Where the product's identity is broader than the plant cultivar and is also dependant on the geographical location, soils, climate and traditional skills of production then Geographical Indicators (GIs), as established under the Lisbon Agreement (http://www.wipo.int/treaties/en/registration/lisbon/summary_lisbon.html) are increasingly being used as the IP right to protect regional horticultural production systems associated with particular product qualities. The first to develop this market position from GIs is the internationally recognised "champagne" designation for sparkling wine produced from grapes cultivated in the champagne area of Northern France. The use of "Protected Geographical Indications" and "Protected Designations of Origin" demonstrate that it is possible to use IP to protect traditional expertise and geographically specialised production systems providing there are particular product qualities associated with the production in that region and the associated traditional knowledge.

Benign predatory and herbivorous insects, aerial and edaphic microbes and naturally occurring plant products which directly or indirectly increase resistance to pests and pathogens are assuming major importance in horticultural crop production. This trend is propelled by consumer demand for residue-free fresh produce, environmental and health protection legislation and imposed by the self-interested supermarket sales system. It is very evident that sustainable crop production will be increasingly important in coming decades (Dixon and Tilston, 2010). Already numerous research organisations and private companies are profiting from the huge opportunities on offer. Participants at all stages in the chain from discovery to marketing are anxious to exploit the opportunities offered by safeguarding their IPR. There are many difficulties which must be surmounted particularly the complexities of patenting microorganisms or plant products where the mode of action is difficult to identify. Patenting microorganisms became easier with The Budapest Treaty for the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (1980, http://www.wipo.int/treaties/en/registration/budapest/). This Treaty allows for one internationally recognised depository for microorganisms rather than sending cultures to each country where patent protection is required.

Novel uses of higher plants for the control of neighbouring weeds or soil borne pathogens and pests by bio-fumigation are already evident and provide opportunities for exploiting IPR. Basic research has identified for example that the tree-of-heaven (*Ailanthus altissima*) produces allelopathic chemicals which inhibit the germination of seeds of competing species. This opens out opportunities for the development of IPR by either artificially synthesising the active molecule or breeding cultivars with enhanced allelopathic properties.

**Figure 4. HortiFair Amsterdam, a world market place for IPR.**

Bio-fertilisers produce benefits beyond supplying crops with nutrients. Some encourage benign and beneficial microbial populations which may be antagonistic to soil borne pests and pathogens. Other usefully sustainable properties include: inhibiting soil nitrification and thereby reducing the formation of nitrates and lowering nitrate pollution in Nitrate Vulnerable Zones (NVZs); stimulating host resistance to heat and cold stresses or increasing chlorophyll production and thereby raising yield and enhancing the appearance and quality of vegetables and fruit (Dixon, 2011). The modes of action whereby these effects are achieved have yet to be elucidated but will eventually offer opportunities for the registration of IPR.

The intellectual property inherent in machinery used in horticulture is currently covered by trademarks and patents ensuring that the inventors and developers are rewarded for the investments made during primary research and development. Horticulture's reliance on hand labour for unpleasant and unsocial work cannot be sustained. Automation and robotics will become commonplace particularly for operations which currently require judgements and decision- making as in crop harvesting. Complex interlocking patents will be needed covering different aspects of these complete processes for the protection of new IP. A prime example of how this approach may be applied is the Bernard Matthews group of companies which brought low cost turkey and other poultry meat to world markets in 1970s. Copying and plagiarism were prevented by a complex series of interlocking patents. A similar approach is now being sought by coffee growers (Herrmann and Marauhn, 2009).

## FRAMEWORKS FOR THE PROTECTION OF IPR

There is a general international acceptance by governments that scientific and technological discoveries lead to innovations that produce forms of intellectual property and in turn this generates wealth for individuals, companies and nations. The IP is an asset that may be registered as a company's property and entered onto balance sheets in similar ways to other forms of asset such as land, buildings or financial investments. Securing a financial premium and market protection through IP generates the funds for future investment creating sustainable economic growth and long-term R&D programmes. The essential cultural elements in an economy which will favour the development and protection of intellectual property rights stemming from horticultural and allied industries are presented in Table 1.

**Table 1. Cultural elements favouring development and protection of property rights.**

- Business favourable climate;
- Entrepreneurial culture;
- Strong IP protection through modernised 21st century IP legislation;
- Participation in the international IP treaties which provide global protection either through international registration systems or through mutual protection within the terms of the treaty;
- Willingness to be flexible and accommodating to the needs of clients;
- Access to capital markets for funding;
- Ability to manage risk and utilise appropriate management structures;
- Long experience of servicing businesses operating by virtual-electronic processes in the financial services sector;
- Opportunities for forming partnerships with the financial services sector;
- Recognition and understanding of the needs of research based industry to safeguard IPR;
- A cultural history that unites intensive plant-based industry with the financial services industry;
- Identification of knowledge management and protection as key aspects required for economies based on scientific and technological innovation;
- Opportunities to develop IPR and knowledge management service companies gaining protection and exploitation rights worldwide with low start-up costs;
- Access to the international conventions particularly UPOV;
- Competitive and equitable arrangements for the taxation of knowledge;
- Protection through trade secrets legislation.

## CONCLUSIONS

Traditionally horticultural scientists have relied on public tax-funded investment with the resulting knowledge placed freely into the public domain. This position has changed radically at least in developed Western and Australasian countries. Horticultural R&D provision is moving from the public sector into large national and multinational companies which either fund in-house studies or employ the best qualified scientists in the residual quasi public sector organisations. The adaptation of horticultural science to this new economic paradigm demands a shift in culture, practices and economic management for those in the quasi public research providers. This follows pathways already well established in the agro-chemical (Hayes et al., 2009), bio-technology (Karapinar and Temmerman, 2007) and pharmaceutical industries.

Value management of horticulture's intangible assets through IP protection and exploitation will provide a market framework which realises returns from existing R&D which has not yet entered the public domain and stimulates funding for future investments. Professional management of IPR is essential and will result in changes to the areas of the world which make its exploitation straightforward and simple. New providers of IPR registration and management will emerge in the 21st century. This differs little from the way geographical areas of world crop production emerged and then changed in the 19th and 20th centuries.

Horticultural science and the industries which it serves can gain substantially by exploiting IPR and the financial returns which it can provide. Ultimately, science and industry will benefit from moving beyond reliance on tax-raised funding. Governments still have responsibilities, however, to ensure that benefits eventually reach all sectors of the industry not solely those big enough to commission research. They also need to ensure that such developments are compatible with their obligations under the Convention on Biological Diversity (http://www.cbd.int/).

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# Southern African Society for Horticultural Sciences

Karin Hannweg

The Southern African Society for Horticultural Sciences was founded in 1989 to promote horticultural science in South Africa and its neighbouring countries. The Society is a science-based organization that provides a forum for liaison between professionals in the research, education, technology, production and industry components of horticultural crops.

The principle objectives of the Society are:

- To promote horticultural science and related research through purposeful scientific communication
- To establish a unified fraternity of horticulturally-orientated scientists from research, education, technology and production centers in southern Africa
- To support a scientific journal, The South African Journal of Plant and Soil, together with our sister Societies involved with Crop Science, Weed Science and Soil Science
- To provide a representative forum with the International Society for Horticultural Science (ISHS) for international interaction
- To facilitate interaction among horticultural professionals working within similar crop focus areas and research disciplines such as fruit, vegetables, ornamentals, landscape, gourmet herbs, mushrooms, plantation crops, medicinal plants, essential oils and aromatics, as well as plants produced for biofuels

SASHS
Southern African Society for Horticultural Sciences

## COMBINED CONGRESS 2011

An annual Combined Congress is held together with the sister Societies of the SASHS, namely the South African Society of Crop Production, the Soil Science Society of South Africa and the Southern African Weed Science Society. The Congress provides a platform for scientists to present their latest findings, as well as to promote networking and sharing of knowledge - not only amongst members of a particular Society, but also between members of sister Societies.

**Participants of the Combined Congress 2011.**

The 2011 Combined Congress was held from 17-20 January 2011 at the University of Pretoria, South Africa, and attracted over 300 delegates with 130 oral presentations and 46 poster presentations. The theme of the Congress was "Taking care of the FOODBALL through science". Delegates focused on innovation, stewardship and scientific advancement, which ultimately leads to practical implementation by growers, who strive to sustainably produce high quality products with a reduced environmental footprint.

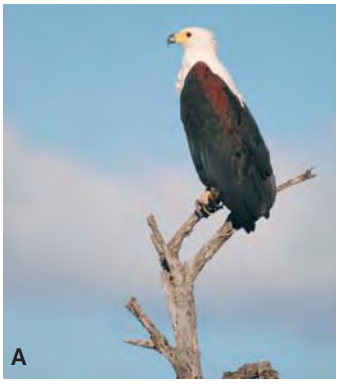
Keynote presentations by invited guests of each Society were delivered during the plenary session, and the Southern African Society for Horticultural Sciences was honoured to have Prof. Jules Janick deliver a keynote address on Fruit Breeding: Past, Present, and Future and also chair a session at the Congress.

In order to develop healthy competition within and between Societies, a number of awards are annually presented to deserving winners at a Gala Dinner at the closure of the Combined Congress. The Southern African Society for

**SASHS Council. Front row (left to right): Dr. Lynn Hoffmann, Dr. Michael Schmeisser, Mrs. Shirley Janick, Prof. John Bower, Prof. Puffy Soundy, Ms. Karin Hannweg. Middle row (left to right): Prof. Jules Janick, Prof. Karen Theron. Back row (left to right): Dr. Wiehann Steyn, Mr. Mark Penter, Mr. Mike North, Dr. Nicky Taylor.**

**Combined Congress SASHS Award Winners. From left to right: Prof. Karen Theron (received award on behalf of Dr. Stephan Verreynne for Best Published Paper in a peer-reviewed journal), Dr. Michael Schmeisser (Best Oral Presentation and Best PhD Student Oral Presentation in Horticulture, winner of Travel Award Bursary to attend an ISHS Symposium), Prof. Jules Janick (invited guest of the Southern African Society for Horticultural Sciences), Mr. Richard Kok (Winner of the Omnia Award for Best Overall Student Oral Presentation across the four participating Societies at the Combined Congress), Mr. Andre Lütge (Winner of the Best MSc Student Oral Presentation Award in Horticulture).**

Conference center.







Selection of Kruger Park wildlife and restcamp images: (A) African Fish Eagle, (B) Baboon family, (C) Cheetah brothers, (D) Elephant family.

Horticultural Sciences presents awards for Best Published Paper in a peer-reviewed journal, Best Oral Presentation, Best Poster Presentation, Best MSc Student Presentation and Best PhD Student Presentation. The Best Student Presentation award is coupled to a travel award, which contributes towards the attendance of an ISHS Conference by the winner. Across the Societies, the Omnia Best Student Presentation is awarded to the student obtaining the highest score as judged across all four Societies. The SASHS is proud of the fact that, once again, this award was presented to a student of Horticultural Science. Good news for Horticulture!

## 2ND ALL AFRICA HORTICULTURAL CONGRESS – SOUTH AFRICA

Following on from the success of the 1st All Africa Horticultural Congress, held in Kenya in 2009, the Southern African Society for Horticultural Sciences (SASHS) will host the 2nd All Africa Horticultural Congress (AAHC II) in the renowned Kruger National Park in South Africa. Under the theme: "Horticulture for Humanity", the Congress will take place at the recently completed conference facility at Skukuza from 15-20 January 2012.

AAHC II will feature a comprehensive Congress programme and aims to bring together international scientists and other stakeholders involved in diverse agricultural endeavours in Africa, providing a platform that will promote communication, collaboration and the sharing of knowledge and expertise for the benefit of our continent and its people. The Congress will further strengthen the voice of African agriculturists in their respective communities and industries. A number of mid-congress technical visits / networking trips will be provided, as well as sight-seeing tours to places of interest in the Lowveld Region.

The Kruger National Park is situated 67 km from Nelspruit, the capital city of Mpumulanga Province. The Region is serviced by the Kruger Mpumalanga International Airport, which has connecting flights to various destinations within South Africa as well as neighbouring countries, and is only a 60 minute drive from Skukuza. Connecting flights to Skukuza airfield are available from certain airports within South Africa.

We look forward to renewing acquaintances with delegates from the previous Congress and taking the opportunity to make new friends!

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# Carrot: History and Iconography

John Stolarczyk and Jules Janick

Carrot is one of the most important root vegetable plants in the world. In its wild state it is a tiny, bitter root with little appeal as a food, but years of human cultivation and domestication, with a helping hand from nature, has made it an extremely versatile vegetable, appearing in several colors, shapes, and sizes. Although cultivated for over 2000 years, and originally used only as a medicinal plant, the domestic carrot (*Daucus carota* var. *sativus, Apiaceae* or *Umbelliferae*) remains an important world crop with production expanding rapidly in Asia. Current world annual production is 27 million tonnes; the leading producing countries, China, Russia, and USA, produce 45% of World output (FAO, 2008). The swollen taproots are eaten both raw and cooked, in sweet and savoury dishes and it is known for its high beta-carotene content, which the body converts to Vitamin A. It also forms a major ingredient in the food processing industry, a significant constituent of cosmetic products and its image has long been used to symbolize healthy eating. The leaves are also consumed in salads and the seeds made into an herbal tea.

## ORIGINS

The domestic carrot is a cool season biennial plant that grows a rosette of leaves in the spring and summer while building up the stout taproot, which stores large amounts of carbohydrates for the plant to flower in the second year. The flowering stem grows to about 1 m tall, with an umbel of white flowers. The roots are greatly enlarged and sweet with good storage ability. Predominantly a temperate climate plant, the carrot is also cultivated in tropical and subtropical regions, especially at high elevations. Originally wild in many parts of Europe and Asia it was first domesticated in Afghanistan, considered to be the primary center of diversity, and from there spread over Europe, the Mediterranean, and Asia, with Turkey recognised as a second center of diversity. During this spread across the world it introgressed with local wild types, some of which have existed since prehistoric times.

Although fossil pollen of the *Apiaceae* has been identified from the Eocene period (55 to 34 million years ago), the wide distribution of wild carrot, the absence of carrot root remains in archaeological excavations, and the scarcity of documentary evidence make it difficult to determine precisely where, when, and how carrot domestication was initiated. Cultivation of carrot in ancient times is still much disputed, mainly because the wild carrot, also known as Queen Anne's Lace, inter-crosses freely with the cultivated carrot. Seeds of wild and early domesticated carrot were used medicinally in the Mediterranean region before they were used as a root vegetable.

### Wild Carrot

Wild carrot is indigenous to Europe, Northern Africa, and parts of western Asia, and seeds have been found dating from Mesolithic times, approximately 10,000 years ago. Different forms of wild carrot, usually recognized as *D. carota* var. *carota*, have small spindle shaped, whitish, slender roots that are aromatic, and acrid with a disagreeable taste. In some countries it is considered a weed. Wild carrot and domesticated carrot continue to grow side by side in the modern world. It is a popular myth that domestic carrot was developed directly from wild carrot, probably because of its similar odor, leaf pattern and growth characteristics. Botanists have failed to develop an edible vegetable from the wild carrot and when the garden carrot reverts to an ancestral wild type it is quite distinct from the wild form.

### The Domesticated Carrot

Almost five thousand years ago, carrots were first cultivated in the Iranian Plateau (Afghanistan, Pakistan, and Iran) and then in the Persian Empire (Brothwell and Brothwell, 1969). Color and flavor were the primary selection criteria for domestication. Root color changed significantly over the domestication period. Wild carrots are white or pale yellow, while purple or yellow were the first colors of domesticates. The domesticated types were divided into two subgroups: Eastern/Asiatic Group (var. *altorubens*) and Western Group (var. *sativus*) as described by Vavilov (1926, 1951).

The Eastern/Asiatic group, the original domesticates, have anthocyanin-pigmented roots, purple, pink, or orangey-yellow, that are often branched, with pubescent slightly dissected leaves that give the plant leaves a grey green appearance. Plants are prone to early flowering. The center of diversity was the Himalayan-Hindu Kush region (Kashmir-Afghanistan) and around Turkestan (Mackevic, 1929; Heywood, 1983). The purple types have poor storage quality and erratic growth. The purple/red pigment based on anthocyanins turns brown upon cooking, and stains hands and cookware.

The Western group evolved later and has unbranched, carotenoid-pigmented roots that are yellow, orange or red, and occasionally white. The strongly dissected leaves are bright yellowish green and slightly hairy. Plants require extended exposure to low temperatures before bolting. The centre of diversity for the western carrot is the Anatolian region of Asia Minor (Turkey) and Iran (Vavilov, 1926, 1951). Orange carrots found in wild germplasm could suggest a Turkish origin (Simon, 2000). These orange types displaced the purple forms in Europe and the Mediterranean by the 17th century through human preference and selection, and formed the basis of modern commercial cultivars around the world, mainly because of their superior taste, versatility, and nutritional value. Thus, the Asia Minor/Mediterranean basin (Turkey) and temperate Europe regions have been considered a secondary center of origin for carrot and the majority of modern commercial cultivars belong to this group.

The yellow/orange color of western carrots is caused by the plastid-bound pigment carotenoids, carotene, and xanthophyll. White carrots contain only traces of pigment, mainly carotene and xanthophyll (Ladizinsky, 1998). The yellow and white types probably originated by mutation. Purple carrots contain anthocyanins, a powerful antioxidant, whilst red contain lycopene, good for eye health, and also found in tomato (Rubatzky et al., 1999).

The modern carrot appears to derive from a combination of mutation and selection from a complex gene pool. These involve yellow rooted eastern carrots, cultivated white-rooted derivatives of wild carrot (grown as medicinal plants since classical times), and wild unselected populations from Europe and the Mediterranean (Banga, 1957a, b, 1963a, b; Heywood, 1983). Orange carrots probably arrived from mutations of yellow forms, and then from human selection, commonly thought to be originated in the Netherlands.

## HISTORY AND ICONOGRAPHY

One of the problems in unravelling the ancient history of carrot is that there is confusion between parsnip and carrot (Hedrick, 1919). The distinction between the two was finally clarified when Linnaeus published *Species Plantarum* in 1753, creating scientific nomenclature. He

called carrots *Daucus carota* (combining Greek and Latin names) and parsnips *Pastinaca sativa*.

## Antiquity

The Greeks refer to wild carrot as *keras, staphylinos agrios*, and *daukos* and early forms of carrot began to be cultivated in the last few centuries BCE (Dalby, 2003). Carrot (*karo*) was first mentioned in the third century BCE by Diphilus of Siphnos. Theophrastus (371-287 BCE) in *Enquiry into Plants IX;15* states that *daukon* grows in Arcadia and is saffron colored (Hort, 1926). It seems clear that the Greeks were aware of carrot, wild carrot, and parsnips.

Wild carrot was reported as a medicinal plant in the gardens of ancient Rome, where it was used as an aphrodisiac and in some cases as part of a concoction to prevent poisoning. In fact the seeds of wild carrot contain estrogen, and in some cultures are used as an effective method of contraception. Archaeobotanists using DNA analysis have found Roman-made pills recovered from a 130 BCE shipwreck that appear to contain carrot (Fleischer et al., 2010).

The famous herbal *Peri Ylis Iatrikis* (latinized as *Materia Medica*) written in Greek about 65 CE by Pedanius Dioscorides, a Roman army physician from Anazabos, Cilicia (now Turkey), describes *staphylinos*, which bears umbellae of white flowers, which are purple or red in the middle (Beck, 2005). This characteristic can only apply to carrot as parsnip has yellow flowers. Both wild [*agrios*] and cultivated [*hemeros*] forms are discussed. The wild plant was thought to ward off reptiles, aid in conception, act as a diuretic, aphrodisiac, and even as an abortifacient when used as a vaginal suppository [pessary]. The cultivated carrot was described as more edible but less medicinally effective.

Interestingly there is also a reference to *daukos* called *Cretan* in which both the seed and root draw out the menstrual period, foetus, and urine, relieve colic, allay chronic coughs, come to the aid of people bitten by poisonous spiders when drunk with wine, and disperse swellings. The Cretan carrot is a related plant, *Athamanta cretensis* sometimes called candy carrot (Candie was the ancient name for Crete). Dioscorides also refers to a plant he called *elaphoboscon*, that had umbellae with yellow flowers. No other umbelliferous plant has yellow flowers and an esculent root except parsnip. The white, sweet edible root is described at about three fingers long and a finger thick with stalk and is used as a vegetable when fresh. Thus, Dioscorides clearly distinguishes carrot from parsnip.

At about the same time, the Roman historian Pliny the Elder (23-79), in *Historia Naturalis* written in the year 77 refers to a plant grown in Syria resembling a parsnip, called *gallicam* in Italy and *daucon* in Greece:

"Petronius Diodotus has distinguished four kinds of *daucus*, which it would be useless here to describe, the varieties being in reality but two in number. The most esteemed kind is that of Crete [*Daucus creticus* or *Athamanta cretensis*], the next best being the produce of Achaia, and of all dry localities. It resembles fennel in appearance, only that its leaves are whiter, more diminutive, and hairy on the surface. The stem is upright, and a foot in length, and the root has a remarkably pleasant taste and smell. This kind grows in stony localities with a southern aspect.

The inferior sorts are found growing everywhere, upon declivities for instance, and in the hedges of fields, but always in a rich soil. The leaves are like those of coriander, the stem being a cubit in length, the heads round, often three or more in number, and the root ligneous, and good for nothing when dry. The seed of this kind is like that of cumin, while that of the first kind bears a resemblance to millet; in all cases it is white, acrid, hot, and odoriferous. The seed of the second kind has more active properties than that of the first; for which reason it should be used more sparingly.

If it is considered really desirable to recognize a third variety of the daucus, there is a plant of this nature very similar to the *staphylinos*, known as the 'pastinaca erratica,' with an oblong seed and a sweet root. Quadrupeds will touch none of these plants, either in winter or in summer, except indeed, after abortion. The seed of the various kinds is used, with the exception of that of Crete, in which case it is the root that is employed; this root being particularly useful for the stings of serpents. The proper dose is one drachma, taken in wine. It is administered also to cattle when stung by those reptiles." (Bostock, 1855, XXV, 64).

In speaking of the medicinal virtue he adds "the cultivated form has the same as the wild kind, though the latter is more powerful, especially when grown in stony places." Pliny called its root *pasticana gallica*, "food for Gauls." Pliny speaks of four kinds of wild carrot (*daucus*), some of which "grow everywhere on earthy hills and cross-paths having leaves like those of coriander, a stem a cubit high and round heads."

Among other vegetables that Syria produces, Pliny refers to one very similar to the *staphylinos*, and known to some persons as "*gingidion*," (wild or French carrot) only that it is more slender than the *staphylinos* and more bitter, though it has just the same properties. Eaten either raw or boiled, it is very beneficial to the stomach, as it entirely absorbs all humours with which it may happen to be surcharged (Bostock, 1855, XX, 16).

There is an intriguing wall painting of a food scene in the Roman tavern in Ostia (Caseggiato del Termopolio) built in the Trajanic-Hadrianic period 98-138 (Fig. 1) that closely resembles carrot or parsnip. If this is so, it is the first known depiction of one of these root vegetables from any period.

Galen (2nd century CE) was the first to use the words *daucus* and *carota* to distinguish carrot from parsnip (*pastinaca*). Galen confirms that *carota* was cultivated when he wrote that the root of the wild carrot was less fit to be eaten than the domestic one (Grant, 2000; Dalby, 2003).

**Figure 1. Carrot or parsnip from a wall painting in a Roman tavern in Ostia (Caseggiato del Termopolio), early 2nd century CE, http://www.ostia-antica.org/regio1/2/2-5.htm.**

This name for the garden carrot is found first in the Roman writings of Athenaeus in 200, and in a book on cookery by Apicius Czclius in 230 in which 3 recipes specifically include carrot. One in particular draws interest as it is entitled "*Carotae seu pastinacae*," suggesting that it is a recipe for carrots, with parsnip as a substitute. Apicius was a gourmet and always tried to include the best ingredients. So here he is perhaps suggesting that carrot is preferred to parsnip.

An alphabetical recension of the *Materia Medica* of Dioscorides was illustrated in 512 (*Juliana Anicia Codex*) for presentation to Juliana Anicia, the daughter of Emperor Anicius Olybrius. A facsimile of this herbal with commentary by Otto Mazel has been published (*Der Wiener Dioskurides*, 1998, 1999). This most famous herbal illustrates cultivated and wild carrots (Fig. 2). Figure 2A, the first clear depictions of an orange carrot, is labelled *Staphylinos Keras* (or cultivated carrot) and portrays a deeply orange straight root with rosette of leaves that looks very close to our modern carrot. Figure 2B, labelled *Staphylinos Agrios* (wild carrot) shows a plant in flower with slenderer orange roots. Figure 2C, labelled *Gingidion*, shows a flowering plant with an extremely fine yellow root and has been identified as *Daucus gingidium. Elaphoboscom* (parsnip) is illustrated separately.

## Medieval

In 795 King Charlemagne included carrots in the list of plants recommended for cultivation in the Frankish empire covering western and central Europe (Fox, 1933). Throughout the Dark Ages and early Middle Ages, carrots and parsnips were the main starchy vegetables for ordinary people in Europe, as they were easy to grow and store and a very welcome food to eat during the lean winter months. In the *Geoponica*, a 20 volume work compiled during the 10th century in Constantinople for the Byzantine emperor Constantine VII Porphyrogenitus, *daucon* is named among kitchen vegetables. Colored illustrations of carrot do not appear again until

**Figure 2. Cultivated and wild carrots from the *Juliana Anicia Codex* of 512: (A) *Staphylinos Keras*, the cultivated carrot; (B) *Staphylinos Agrios*, the wild carrot, but appears to be a primitive type of cultivated carrot; (C) *Gingidion*, the wild carrot (*Daucus gingidium*).**


the 11th century but, as typical of early medieval images, are very crude, yet nevertheless quite accurate (Fig. 3).

Towards the end of the Dark Ages, purple, red, and yellow carrots were reintroduced to Europe from Central Asia by the Arabs. Around 950, Ibn Sayyār al-Warrāq of Baghdad produced a cookbook, the most comprehensive work of its kind with more than 600 recipes that included red-orange, yellow or white carrot (*jazar*) (Harvey, 1992). These were cultivated in Persia in 900, Iran and northern Arabia and the Middle East, in the 10th century, in Syria about the 11th century, and in Europe about 1100 (Banga, 1957a, 1963a). Carrots were valued for their sugar content and sweet dishes like jam, syrups and desserts, and became part of traditional English cookery during this medieval period.

The late 11th century witnessed an intriguing manuscript *Bodlean 130, Herbal of Pseudo-Apuleius*, which illustrates carrot root, leaves and flower quite accurately with yellow-orange roots (Fig. 3A). The script indicated that the Greeks called it *stafilimagriam*, others called it *giger* or *eggon*, the Romans called it *udonaulion*, the Carthaginians called it *siccansade*, the Calabria (Italy) called it *pastinaca silvatica*. The text states: "It grows in stony places and mounds; for women who suffer at childbirth and are not purged. With *Herba pastinaca*, cooked, together with the same water in which it was cooked, you take 30 peppercorns; mix together and give to drink; she will be purged. The same recipe as written above also works against toothache." Two manuscripts, Ashmole 1462 labelled *Pastinaca Silvatica* (Fig. 3B, a yellow/orange root) and Ashmole 1431 labelled *Pastinaca* (Fig. 3C, a darker red root), contain essentially the same text.

Arab traders and Moorish invaders brought carrots to the Northern Mediterranean, while at the same time carrots travelled eastwards along the caravan routes and the Silk Road (Davidson, 1999; Grigson, 1974; Dalby, 2003). By the 12th century carrots were reported in Spain, followed by Italy in the 13th, and France, Germany, Holland and England by the 14th century.

The discovery of a large quantity of what appear to be processed carrot roots was found in the main market square in Krakow, Poland, in an organic layer dated to the 14th century (Mueller-Bienik, 2010). The exquisitely illustrated manuscripts known as the *Tacuinum Sanitatis*, a medieval handbook on wellness, commissioned by northern Italian nobility during the last decades of the 14th century contains images of plants called *pastinace* but some of them are obviously carrot (Fig. 4).

## Herbals

The advent of printing in the 15th century and the technology of the woodblock print had an enormous influence on books about plants. The 15th and16th centuries – the age of exploration and the beginnings of scientific inquiry – saw an unprecedented demand for the printed

**Figure 3. Orange and reddish carrots from 11th century manuscripts: (A) *Herba pastinaca, Pseudo-Apuleius, Dioscorides*, from Bury St Edmonds, England. (B) *Pastinaca Silvatica*, Bodlean Image Ashmole 1462; (C) *Pastinaca*, Bodlean Image MS Ashmole 1431.**

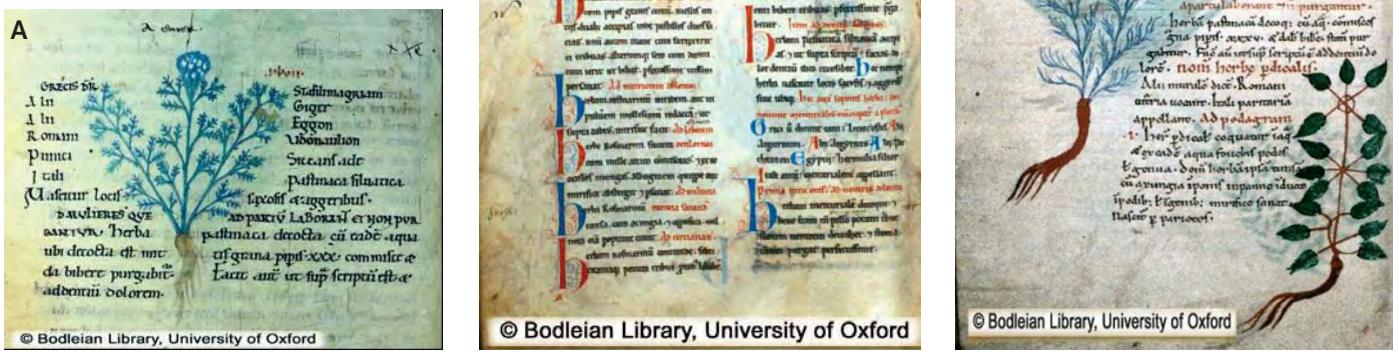

**Figure 4. Peasant digging carrots from the *Tacuinum Sanitatis*, Roma 4182, 1380-1400. The long, thin roots, either purple or light yellow, intermingled in the foreground row and in the harvested pile clearly represent carrot. The Latin text reports that pastinace stimulates sexual intercourse but slows down digestion, and that the purple type, ripe in winter, is the best.**


herbal by physicians, apothecaries, and wealthy people who needed a source for remedies that existed at the time. For the first time carrot root colors were accurately described while hand-tinted editions confirm what color was being referred to in the text, Leonhart Fuchs in 1542 in his *Historia Stirpium* (*On the History of Plants*) described red and yellow garden carrots and wild carrots, but names them all *Pastinaca*. The famous Flemish physician and botanist Rembert Dodoens is best known for his herbal *Cruydeboeck*, written in old Flemish and published in 1554 (Fig. 5). It was illustrated by 715 woodcuts of plants, including many copies from those in the Fuchs herbal. He indicates the localities and times of flowering in the Low Countries. The work was used for several centuries as a standard reference book for physicians, and the Latin translation was used by Gerard as a source for his now-famous 1597 *Herball,The Historie of*

**Figure 5. Yellow and red carrots from Rembert Dodoens' *Cruijdeboeck*, 1554.**


*Plantes*. Gerard uses the English name carrot, but in Latin calls it *Pastinaca*: *P. sativa* var. *tenuifolia*, the yellow carrot and *P. sativa atro-rubens*, the red carrot. He distinguishes parsnips from carrots, calling the former *P. latifolia sativa* and the latter *P. latifolia sylvestris* and expresses dissatisfaction with the name similarity. He notes *Daucus* as a name for carrot used by Galen, but notes that many Roman writers called it *pastinace* or other names.

## Renaissance Paintings

The villa of Agostino Chigi in Rome contains decorations by Raphael Sanzio made between 1515 and 1517. The ceiling of the loggia of Cupid and Psyche derived from the Metamorphoses (Golden Ass) of Apuleius in the 2nd century contains festoons painted by Giovanni Martini da Udine that illustrate 160 species of plants. An orange carrot appears alongside a purple root (Fig. 6). Another ceiling panel depicts an orange carrot alongside a white rooted parsnip.

**Figure 6. Orange and purple carrot from the Loggia of Cupid and Psyche, figures painted by Raphael Sanzio, festoon painted by Giovanni Martini da Udine, 1515-1518.**

The emergence of Dutch and Spanish paintings depicting market and kitchen scenes in the 16th century coincides with the period and location that carrot was further developed in Europe. Figures 7-9 provide examples of the colors and shapes of carrot and parsnip roots and similar paintings from the same era and locality were used as evidence by Banga (1963b) to develop his treatises on the origin and distribution of western carrots.

**Figure 7. Purple and pale yellow carrots in Vegetable Market (1655-1665), Nicholaas Maes (Dutch) (Rijksmuseum, Amsterdam).**

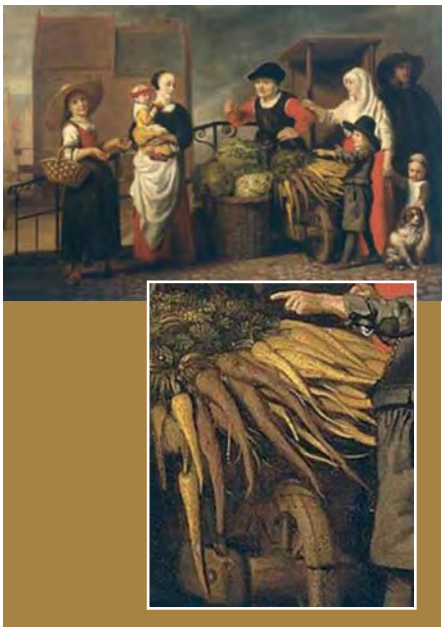

**Figure 8. Still life with Game, Vegetables and Fruits of Juan Sánchez Cotán (Spanish), 1602, showing purple and yellow carrot (left) and radish (Museo del Prado, Madrid).**

**Figure 9. Yellow carrots and parsnips from The Greengrocer 1731, Willem van Mieris (Dutch) (Wallace Collection London).**

## The Modern Era

European carrot improvement began with material imported from Arab countries, consisting of a purple type, called red by authors before 1700, and a yellow type. Purple types were noted in France in the 1300s and a bit later in Holland and Germany. The yellow forms were noted in England, France and Germany in the 1500s. The yellow carrot became more generally used than purple and it gradually spread throughout Europe superseding the purple in the 16th century (Banga, 1957b).

By the 1700s, Holland was a leading country in carrot development and Banga proposed that "modern" orange version is directly descended from the Dutch-bred carrots of that time. The 'Horn' carrots (named after the town of Hoorn and common in Amsterdam about 1610) were developed in Holland, and the 'Long Orange' was likely to be from selection of a yellow, possibly crossed with an orange/red variety that was unpalatable (Fig. 10). By 1763 carrots were classed as one of four types: 'Long Orange' and three cultivars of Horn Carrot – 'Late Half Long', 'Early Half Long', and 'Early Scarlet Horn'. The modern western orange cultivars of carrots derive from these four types (Smartt and Simmonds, 1976).

**Figure 10. Carrots from Vilmorin's *Vegetable Garden* (1586). (A) Early Horn; (B) Dutch Horn.**

A


B


In the 18th and 19th centuries an increasing amount of horticultural literature emerged and carrots were included in several homeopathic remedies. For instance John Wesley's little treatise entitled *Primitive Physic; Or, an Easy and Natural Method of Curing Most Diseases* (1761); chiefly relied on native plants; he advised the sufferer of asthma to "live a fortnight on boiled Carrots only, it seldom fails." A carrot poultice is also recommended for putrid wounds.

Carrot arrived in America with the Pilgrims in 1609 and soon became part of the staple diet. It was also adopted by the native Indians as a food source. The British took the carrot to Australia in 1788. The cheap and accessible orange root was constantly popular as a staple food throughout Victorian times. Many books and literature on household management extolled the virtues of the versatile and tasty humble carrot such as *Mrs Beeton's Cookbook* of 1861, the most famous and esteemed English cookery book of that era, bringing basic cooking advice to the masses in a form and structure that is still used.

World War II revived the popularity of the carrot, elevating it from a mere animal feed to a major food source. The character Doctor Carrot (Fig. 11) was devised in 1941 by the UK Ministry of Food to promote carrots as a substitute for other more scarce vegetables in the campaign called Dig for Victory. The legend about eating carrots to improve night blindness has its roots in World War II when the British government, urging people to grow and eat carrots to ease food shortages, put out a story that the consumption of special high carotene carrots was the reason for the success of the Royal Air Force gunners during the blitz, as a ruse to obscure the launch of the new airborne radar system as well as the use of red light (which helps preserve night vision) in aircraft instruments. Eating carrots does not improve your vision, but the lack of vitamin A can cause night blindness, and carrots are high in vitamin A.

**Figure 11. Dr Carrot, a UK promotion in 1941 during World War II.**


## Recent Developments

In the 1960s, carrots became more standardised as supermarkets demanded uniform size and shape. The supermarket boom continued into the 1970s. Pre-packaging became the order of the day and gave the producers more advertising and marketing opportunities with brightly colored orange striped plastic bags, making the carrots inside look even more attractive, a practice that continues today. Breeders introduced literally hundreds of cultivars; the most widely favored types grown in temperate climates are 'Danvers', 'Imperator', 'Nantes' and 'Chantenay', whereas in subtropical areas 'Kuroda', 'Brasilia' and tropical 'Nantes' are popular.

In China and Japan, however, yellow and red types are very popular. The purple and yellow carrot varieties are making a comeback and are proving popular in the farmers markets in the US and the UK. In a quite bizarre way the purple carrot has turned full circle and the color originally used to dye the royal robes of ancient Afghans is now an essential part of the food coloring industry.

The natural colorant from purple carrots is used in a myriad of items such as candies, juices, and fruit preparations. Many countries are now marketing "rainbow" carrots, mixed bags of red, yellow, white, purple and orange carrots, and this novelty seems to be successful (Fig. 12).

Modern breeding now concentrates on producing strains with even coloring, uniform size, tender flavor, and greater yield (Simon, 2000). Greater resistance to bolting is another aim of breeders together with carrot fly resistance and, increasing tolerance to heat and drought. Carotene (present in small amounts in wild carrot) has been increased by centuries of selection and development but volatile oils have been decreased in this process, affecting flavor.

**Figure 12. A wide range of carrots available today (photo credit USDA).**

Baby carrots were created in the late 1980s as a way of making use of carrots that are too twisted or knobbly for sale as full-size. These were heavily promoted in the US in 2010 through a $25 million campaign to attract young people to eat more carrots through the "Eat 'em like junk food" campaign. They are on sale in school vending machines and via seasonal promotions such as "Scarrots" at Halloween! Some baby types are actually young carrots planted at very high densities and generally are more expensive but most are "created" from pieces of larger roots (Fig. 13).

The virtues of carrot are still being expanded in the 21st century. In 2008 a "super carrot" was announced containing much higher levels of calcium. Carrots have been promoted as a future ingredient in biofuels. A polymer derived from

**Figure 13. Organic baby carrots (Grimmway image).**

carrots and other root vegetables is now used to fabricate a racing car steering wheel and fishing rods. The oil from carrot seeds has proved to be an excellent lubricant in industrial applications. Carrot appears in a multitude of skin and hair care products. Finally, a plant compound found in carrots called luteolin has been shown to help reduce age-related inflammation in the brain and memory deficits (Jang et al., 2010).

### Parsnip - The Cinderella of the Vegetable Kingdom

If carrot is the Prince Charming of the root vegetables, then parsnip is surely Cinderella, unloved, ignored, and rejected. This sweet and delicious root vegetable, resembling an overgrown ivory-skinned carrot, probably had equal and aristocratic status with the carrot in Greek and Roman times and its spread into Western Europe is not separately documented. Historical references to carrot and parsnip are intertwined; early medieval carrots and parsnips were both thin and woody and mostly of a vaguely whitish color. This being the case, almost everyone up to the early modern period can perhaps be forgiven for failing to distinguish between the two, however frustrating this may be for the food and agricultural historian.

In classical and medieval writings both vegetables seem to have been sometimes called *pastinaca* and without associated evidence of color or taste, it is difficult to distinguish the two. By the Middle Ages the parsnip was a popular vegetable in Europe, particularly as fleshier and tastier roots were developed, and often used to sweeten dishes in the absence of sugarcane not yet imported in bulk from the New World plantations and at a time when honey was a rare and expensive luxury. Before the potato arrived in Europe, parsnip was the staple starch crop.

Gerard's 1597 *Herball*, speaking of its uses as a vegetable, observes: "The Parsneps nourish more than do the Turneps or the Carrots, and the nourishment is somewhat thicker, but not faultie nor bad. There is a good and pleasant foode or bread made of the rootes of Parsneps, as my friend Master Plat hath set foorth in his booke of experiments. It is said that Marmalade made with the roots, and a small quantity of sugar, will improve the appetite, and serve as a restorative to invalids."

Although parsnip was introduced by Europeans into North America with the carrot, it never really sustained favor and was placed in the shadow of the gorgeous carrot and the more productive potato. This under-rated vegetable needs further attention from the scientific community as there is a genuine fear that it will disappear into obscurity. Like Cinderella it deserves a much higher standing amongst its peers.

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# The Biological Section of the Voynich Manuscript: A Textbook of Medieval Plant Physiology?

**Lincoln Taiz and Saundra Lee Taiz**

The Voynich manuscript, written in a mysterious cipher and illustrated in a herbal-like form with stylized paintings of bizarre, unidentifiable plants, remains to this day one of the most enduring enigmas of the medieval period (Kennedy and Churchill, 2004). Discovered in 1912 by the antiquarian book dealer Wilfred M. Voynich, the vellum codex has since attracted legions of cryptoanalysts and history sleuths (but unfortunately few professional botanists) dedicated to unlocking its secrets. Voynich apparently happened upon the codex during a book-hunting expedition in Frascati, Italy, near Rome at the Villa Mondragone, then a Jesuit college. The Villa had been built in 1573 by a wealthy Cardinal and used as a summer residence for Pope Gregory XIII. Voynich later found a letter written in Latin inside the book, signed by Joannes Marcus Marci of Cronland, Prague, and dated August 19, 1665. According to Marci, the book had once belonged to the Holy Roman Emperor Rudolph II (1552-1612), who believed it to be the work of the 13th century English cleric, Roger Bacon. Although the codex's authenticity has often been questioned (e.g. D'Imperio, 1978; Schinner, 2007), its medieval origin has recently been confirmed by carbon-14 analysis (Greg Hodgins, pers. commun.). The parchment dates to the early fifteenth century, between 1404 and 1438. In addition, the ink used in the manuscript is consistent with a medieval origin, although there is no way of telling when it was applied to the vellum (Rene Zandbergen, pers. commun.). These findings rule out the 13th century scholar Roger Bacon as the author, an idea favored by Voynich himself (Kennedy and Churchill, 2004).

The Voynich codex is currently housed at the Beinecke Rare Book Library at Yale University, which maintains a gallery of digitized images of the 246 pages of the manuscript on its website (http://beinecke.library.yale.edu/dl_crosscollex/SearchExecXC.asp). The first part of the codex (folios 1r-66v), often referred to as the "Botanical" or "Herbal" section, contains crudely executed paintings of stylized plants, sketched in ink and filled in with washes of green, brown, yellow, blue, and red (D'Imperio, 1978). Few, if any, of the plants are identifiable, although resemblances to actual plants can be found by the determined observer. For example, the plant in Fig. 1A is stylized beyond recognition, although the plants in Fig. 1B and C bear some resemblance to sunflowers. However, sunflowers only appeared in Europe after 1492, decades after the supposed age of the manuscript according to the carbon-14 dating results. A closer inspection of the "sunflower" in Fig. 1C reveals a cross outlined in seeds (Fig. 2). This suggests that the artist considered the religious or philosophical significance of the drawings in the Herbal section at least as important as naturalistic representation, if not more so.

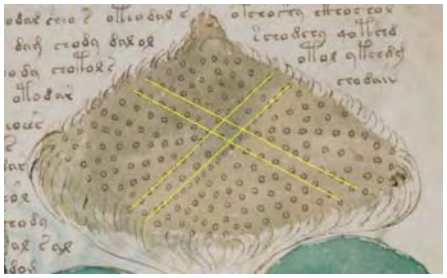

**Figure 2. Close up of seed head of the "sunflower" in f.93r showing two pairs of parallel lines (indicated in yellow) traversing the seed head, forming the outline of a cross.**

The remainder of the codex has been divided into five different categories depending on

**Figure 1. Three pages from the Herbal section of the Voynich manuscript: (A) unidentifiable decorative plant, f.16v; (B) sunflower-like plant with lobed leaves and strange "galls" on the roots, f.33v; (C) another sunflower-like plant, f.93r.**

**Figure 3. Illustration from the Biological section of the Voynich Manuscript showing nude female figures dancing or bathing in two vats of green liquid (f.78r).**

the types of illustrations: the "Astrological" or "Astronomical" section (folios 67r-73v), the "Biological" or "Balneological" section (folios 75r-84v), the "Rosette" or "Medallion" section (85r-86v), the "Pharmaceutical" section (folios 87r-102v), and the "Continuous Text" section (folios 103r-117v). The Pharmaceutical section also includes some herbal illustrations as well (folios 90r-96v). Although some of the drawings are reminiscent of the astrological or alchemical herbals of the Middle Ages (Toresella, 1995), taken as a whole the illustration program of the Voynich manuscript is unlike that of any other extant medieval herbal.

The script used in the text of the Voynich manuscript is also unique (see Fig. 2). Despite the best efforts of some of the world's top code-breakers, including William Frederick Friedman, America's chief cryptoanalyst during World War II, who cracked Japan's notorious "Purple Cipher," the text of the Voynich manuscript remains as opaque today as the day it was discovered. Some of the characters resemble alchemical symbols and others resemble Arabic numerals (D'Imperio, 1978). Assuming the cipher represents a known language, such as medieval Latin, the words could have been encrypted either by *transposition* or *substitution*. Transposition involves rearranging the letters of words – in effect, turning them into anagrams. In contrast, substitution retains the order of the "letters," but substitutes other letters or symbols in their place. Although no generally accepted interpretation has emerged from the plethora of theories regarding the nature of the cipher, those cryptoanalysts who have labored longest on the problem generally agree that the cipher cannot be based on a simple substitution method (Bennett, 1976; Zandbergen, 2011).

There is also a third possibility: the Voynich text could be written in a private language. This was the final assessment of William F. Friedman, and some cryptoanalysts have come to the same dismal conclusion (D'Imperio, 1978). Dismal, because a cipher written in a private language would be the most difficult to unravel without the benefit of a key, like the Rosetta Stone. While this has not stopped avid aficionados from pursuing the meaning of the text, there is a growing fear that the cipher may never be cracked. If not, the illustrations may provide the only clues we will ever have to the significance of what has been called "The most mysterious manuscript in the world" (Manly, 1921).

Arguably, the most intriguing and delightful illustrations of the Voynich manuscript are contained in the so-called Biological section, which features cartoon-like drawings of nude female figures busily engaged in various activities, either in groups or individually. Some seem to be dancing while holding hands in vats of green liquid, which are connected to each other by sections of pipes comprising a plumbing system (Fig. 3). Some are interacting with flexible tubes through which liquid seems to be flowing (Fig. 4). What could these drawings possibly mean?

## INTERPRETATIONS

According to one hypothesis, the drawings with the nude females comprise a health manual for women. The liquid-filled vats represent therapeutic hot spring baths; hence the alternative moniker "balneological." According to a second hypothesis, the various tubes and bath-like structures represent the uterus and other organs of the female reproductive system. According to this theory the Biological section might be a medieval manual of gynecology. Yet, apart from the spa-like baths, it is difficult to identify anything that might be construed as gynecological among the many drawings of women (Kennedy and Churchill, 2004). Moreover, the dominant color of the liquid is green, consistent with a botanical interpretation. A botanical interpretation would tie the Biological section more closely to the main Herbal section of the manuscript.

**Figure 4. Selected illustrations from the Biological section of the Voynich Manuscript showing nude female figures carrying out various tasks: (A) f.79r; (B) f.77r ; (C) f.82r; (D) f.83v.**

*De Plantis* by Nicolaus of Damascus (c. 63 BCE – 14 CE) could well have been the source of the botanical ideas presented in the Voynich manuscript. Roger Bacon (ca. 1214-1294) had based his university lectures on plants, summarized in *Questiones supra de Plantis* (ca. 1245), on *De Plantis*, and Albertus Magnus (ca. 1206-1280) in his *De Vegetabilibus* (ca. 1260) provided additional commentary on the questions posed in *De Plantis* (Reeds, 1980). We therefore propose that the Biological section addresses at least four of the questions discussed in *De Plantis:*

1. What is the origin of the green color of stems and leaves?
2. How is water and nutriment from the soil digested, translocated, and assimilated in plants?
3. How are leaves, flowers, and fruits produced?
4. What is the nature of the plant soul?

These were all questions that had been discussed in *De Plantis* in terms of the four elements and the Galenic humors theory.

Consider the illustration shown in Fig. 3. In the upper left and right corners we see two stylized objects that could be plant reproductive structures – flowers, fruits or cones. The upright twig-like structures at the tops resemble the styles and stigmas of pistils. Flowing either into or out of the bases of these two structures are streams of liquid passing through a series of short pipes connected to two vats containing a green liquid in which nude females are dancing or bathing.

Setting aside the significance of the nude females for the time being, let us focus on the two other striking elements of the drawing: the green liquid and the short pipes. It is reasonable to assume that the green color that dominates the Biological section of the manuscript represents the green pigment of leaves and stems: chlorophyll. In *De Plantis*, Nicolaus discusses the green color in the bark of trees:

> The whole tree ought to be of a green color, and that is because the food is attracted and the wood of the tree rarefied, so that owing to the heat a small quantity of concocted food percolates, and the moisture remains with it. In consequence, it appears on the outside, and then the green color will be [seen]. This is also the case with leaves, but there is more concoction in them. That is the difference in power between leaves and bark.
>
> – From *De Plantis*, based on Arabic translation II 8.216-221; Drossaart Lulofs and Poortman, 1989, p.202.

This passage suggests that the green color is the result of the "percolation" of "concocted" (digested) food from the wood to the bark. The idea of "concoction" in plants was based on the theories of Aristotle and Galen on the digestion of food in animals. The Greeks envisioned digestion as a two stage process: the first stage was concoction of the food in the stomach by heat to form the "chyme"; the second stage was the concoction of chyme in the liver to form "nutrient blood"; the last stage was the transformation of nutrient blood into bone, flesh, and tendon (Powell, 2003).

According to Nicolaus, leaves, unlike roots and the woody trunks of trees, are able to concoct their own food, hence they are green throughout. Regarding the locations where concoction takes place, the Arabic version of *De Plantis* has this to say:

> The first concoction takes place in the lower part of the plant within the earth, and the second in the marrow outside the earth which is in the middle of the plant; thereupon the nutritive materials make their appearance in order to be distributed.
>
> – From *De Plantis*, based on Arabic translation II 8.222-227; Drossaart Lulofs and Poortman, 1989, p.204.

In other words, concoction of the soil in plants is similar to the digestion of grass in ruminants – it takes place in stages at various locations. The root first absorbs nutriment from the soil and carries out the first stage of digestion. The partially digested material is then transported upwards through the "marrow," or pith of the stem, which, Nicolaus tells us, some call the "womb", while others call the "vitals" or the "heart" of the tree. About halfway up the tree, the concoction is further digested, although not completely, before being passed on to the leaves, where the final digestion takes place. As discussed by Karen Reeds (1980), Albertus Magnus, writing in *De Vegetabilibus* around 1260 CE, described the process of leaf production as the extrusion of partially digested food from the pores of the stem:

> [Albertus] first established that in general leaves were formed from an ill-digested mixture of a watery vapor and a dry earthy excrement which was exuded or exhaled from pores in the stem, propelled by a certain generative, formative power within the plant.
>
> – From Reeds, 1980, p.352.

Returning now to the Voynich manuscript, we postulate that the green liquid in the vats in Fig. 3 represents a fermenting (digesting and concocting) mixture of earth and water. The lower vat represents the first concoction in the root, because it is the lowermost part of the system. The upper vat might represent either the second concoction in the "marrow" of the stem or the third concoction in the leaf. In this model, the green liquid is moving upwards to the aerial portions of the plant. In *De Plantis*, the upward movement of digested food from the root to the shoot is likened to steam rising from a bath, consistent with our hypothesis. According to Nicolaus, upon reaching the extremities of the plant, the steam condenses back to a liquid and flows back down to the root, forming a bidirectional circulatory system similar to that of animals (anticipating Harvey's theory of the circulation of the blood):

> It is not in the nature of water to rise upwards, but the heat draws the moisture into the extremities of the plant, so that the food will get to all its parts, while that which is superfluous is secreted. Just as in a bath, the heat attracts the moisture and then turns it into vapor which rises, and when it abounds in the place, it returns in drops. Similarly, the superfluities in animals and plants return from the upper to the lower part and rise in their actions from the lower to the upper.
>
> – From *De Plantis*, based on Arabic translation II 1-2.145-151; Drossaart Lulofs and Poortman, 1989, p.176.

## A MODERN EXPLANATION

Although the details of the mechanism are incorrect, a modern plant physiologist can recognize several key concepts involved in the movement of sap that are still valid today. For example, heat is involved in driving the evaporation of water ("transpiration") from the pores (stomates) of leaves, which generates the attractive force that pulls water up the stem through the tube-like nonliving water conducting cells, the xylem elements. The idea of a water circulatory system in plants is also valid, as some of the water that arrives in the leaves via the xylem can be returned to the root via the phloem, the system of living tube-like cells involved in transporting sugars throughout the plant. Xylem and phloem comprise the vascular tissue of plants.

The porosity of woody tissue was observed by Greek natural philosophers, even without the aid of microscopes, and this no doubt gave rise to the idea of "ducts" for the transport of water and food. In *The Parts of Animals*, Aristotle had compared both animal "blood vessels" and plant "vessels" to garden irrigation systems:

> The water-courses in gardens are so constructed as to distribute water from one single source or fount into numerous channels, which divide and subdivide so as to convey it to all parts … Now just after the same fashion has nature laid down channels for the conveyance of the blood throughout the whole body, because this blood is the material out of which the whole fabric is made. This becomes very

**Figure 5. Decorative floral motif. Enlargement of the floral motif in Figure 4C.**

> evident in bodies that have undergone great emaciation. For in such there is nothing to be seen but the blood-vessels; *just as when fig-leaves or vine-leaves or the like have dried up, there is nothing left of them but their vessels* [italics added].
>
> – Aristotle, *The Parts of Animals* Book III, Part 5. Translated by William Ogle (1882) London.

Albertus Magnus had also pulled apart a leaf of plantain and observed the fibrous strands of the vascular tissue (Reeds, 1980). By the same argument, Fig. 4A could also be interpreted as a vascular strand transporting concocted food from the root to the shoot and back again. The small basins at different heights in which the nude females are standing could correspond to leaf nodes, where vascular tissue diverges from the stem to the leaf. According to *De Plantis,* the diameters of the ducts can regulate growth in different directions, causing the plant to grow either up, down, or horizontally. This is reminiscent of the topic of "nutrient allocation" in modern plant physiology, whereby nutrients are preferentially translocated to specific organs, such as growing fruits, at different times of development.

Fig. 4C could represent the process of seed production. A nude female pushes liquid through a T-shaped tube, which gushes toward a flower-shaped object to the right. A line extending from the "flower" bends and terminates in a small star, which hovers over a sleeping female cradled in a bed-like structure. An enlargement of the "flower" is shown in Fig. 5. This appears to be a purely decorative floral motif, similar to those found in the margins of illuminated manuscripts (for example on the lower border of the frontispiece to the *Antidotarium Nicolai,* Egerton Ms. 747, fol. 112).

We interpret the enigmatic "flower-seed" sequence in Fig. 4C as follows: The material pushed through the tubes towards the flower represents the generative liquid or vapor, derived from the pith or marrow of the stem, which gives rise to the seed, represented by the sleeping female in her capsule-like "bed." It is stated in *De Plantis* that each plant germinates and grows according to its "star." The star-on-a-string motif, which appears elsewhere in the cosmological diagrams of the manuscript, could represent the psyche or soul of the plant, which is governed by the heavens.

Fig. 4D could represent either two leaves being extruded from the pores of the stem, or two fruits growing in response to the translocation of concocted food brought to them via the vascular system. According to *De Plantis*, the lightest vapors arrive in the vascular system first to form the flower, followed by the heavier, earthier material, which forms the fruit. The green color and shapes of the "fruits" suggest that they could be gourds. Gourds symbolize the resurrection in Christian art (Ferguson, 1961). They were also used by pilgrims as flasks to carry water, consistent with their role as the ultimate destinations of the green liquid that nourishes the plant.

Finally, what can we say about the significance of the nude females? If we adopt the view that their function in the manuscript is to delight, entertain, and instruct the reader, the nude females may serve as metaphors for the vital force, or vegetative souls, of the plant, which, according to Aristotle, directs the growth, development, and reproduction of each plant species. Women had been strongly identified with plants throughout antiquity, and this association strengthened during the Middle Ages and Renaissance.

If we accept the idea that the female figures represent vegetative souls, why are there multiple "souls" within a single plant? How many souls does an individual plant have? In his treatise *On the Soul* (Book I, Part 4), Aristotle expressed the belief that the higher animals must possess a single soul, because cutting them in half invariably kills them. In contrast, plants can be divided up into many segments, and each segment can potentially survive and regenerate another plant. Aristotle inferred from this ability to propagate plants from cuttings that plant souls can multiply and spread throughout the plant, endowing each part with regenerative powers.

If our hypothesis is correct, what are the female vegetative souls actually *doing* in the large green vats? An analogy can be made between the process of decoction discussed by Aristotle and the process of crushing and fermenting grapes to make wine. Indeed, the two objects in the upper corners of the drawing, from which or to which the liquid is flowing, could represent stylized bunches of grapes. We propose that the artist may have depicted a scene resembling grape crushing as a humorous (and no doubt familiar) metaphor for the concoction of earth and water, which, according to Aristotle/Nicolaus, produces the green substance of plants. The use of women to carry out this joyful process is a time-honored tradition, still practiced today at various wine festivals, and is yet another association of women and agriculture.

**Figure 6. Christian symbols in the Biological section: Christian cross and possible rosary, f.79v.**

However, lest we misinterpret the Biological section as an exercise in pagan philosophy, the artist has inserted a few Christian symbols. As shown in Fig. 6, the nude female figure in the uppermost structure holds a cross, symbolizing Christ, while the figure below her holds a ring-shaped object with an ornament at one end. Although there are no visible beads, the ring-like structure could represent a schematic rosary, symbolizing the Virgin Mary. We have found several female figures holding such rosary-like objects, but only one cross, consistent with the overall feminine theme of the Biological section.

Much more could be speculated about the marvelous illustrations of the Voynich manuscript, but we have probably exceeded our quota already. One aspect of the illustrations seems indisputable, however, and that is that images of plants and women predominate. If our interpretation is correct, what makes this medieval codex unique is that the artist does not depict secular scenes of courtly love with maidens in enclosed gardens, or religious scenes of the Virgin Mary surrounded by her roses. Rather, the author depicts a philosophical scene in which women represent vegetative souls located within the very marrow of the plant, driving the processes that make plants grow and reproduce.

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# The Pear Industry in China


**Yuanwen Teng**



In China, 13 *Pyrus* species have been described and more than 3000 cultivars have been recorded. Recent results using DNA markers have revealed the genetic phylogeny and diversity of *Pyrus* species and the evolution and development of cultivars. Cultivars are mainly originated from *P. ussuriensis*, *P. pyrifolia*, and *P. singkangensis*. Pears are grown in nearly every province or region of the country with different predominated species and cultivars. Although traditional cultivars still account for over 50% of total pear production, recently released cultivars are becoming leading cultivars in some regions. China is also the world leading country in pear production, with an annual output of more than 14.39 million tonnes (t) and 1.26 million hectares (ha), which account for 65.7% of world production and 72.3% of world growing area, respectively. Pear industry ranks third in fruit industry after oranges and apple in China. The vast area of pear growing contributes to greatly different systems of orchard management. Generally speaking, pear trees growing in North China are trained as a central axis or leader form, but in South China, especially in newly planted orchards, open-center tree form is usually used. Recently, the trellis pergola training system prevailing in Japan has been introduced into some areas of China. Due to lack of dwarf rootstocks, most old orchards were established with low planting density. However, newly planted pears with vigorous rootstocks and high planting density tend to be managed with intensive systems, resulting in poor yield and quality as the orchards age due to poor light penetration. Artificial pollination and fruit bagging have become regular practices and related research has been carried out to obtain the best pollinators and most efficient fruit bags. To meet the increased requirements for consumer safety, integrated pest management (IPM) has become more and more popular, including the use of pheromone mating disruption, yellow sticky traps, and insect trapping lamps. However, chemical sprays are still regularly used to control serious diseases.


## PYRUS GERMPLASM RESOURCES IN CHINA

China is a large continental country with diverse climates that contains the most plentiful *Pyrus* germplasm resources in the world. Based on an extensive investigation, 13 species have been described by taxonomists (Table 1). Among these *Pyrus* species, only a few species have been cultivated for commercial production. The commercial pear cultivars native to China are composed of four main groups: Ussurian pear (*P. usssuriensis*), Chinese white pear (*P. pyrifolia*, Chinese white pear group, formerly also assigned to *P. ×bretschneideri*), Chinese sand pear (*P. pyrifolia*) and Xinjiang pear (*P. ×sinkiangensis*). Besides the major cultivars, the minor cultivars originated from *P. ×phaeocarpa*, *P. pashia* and unidentified hybrids are also grown in some areas of China (Teng and Tanabe, 2004). Chinese white pear cultivars are the most widely cultivated in Northern China and have been long assigned to *P. ×bretschneideri*. Recent studies with different DNA mark-

**Table 1. *Pyrus* species native to China and their utilization. Source: Yu (1979) and Challice and Westwood (1973).**

| Species | Distribution | Utilization |
|---|---|---|
| *P. betulaefolia* Bge. | Mainly Northern China | Rootstocks in Northern China |
| *P. calleryana* Dcne. | Central and Southern China | Rootstocks in Southern China |
| *P. xerophila* Yu | Mainly Gansu, Qinghai Provinces | Rootstocks in Gansu, Qinghai and Xinjiang |
| *P. pashia* D. Don | Southern China | Rootstocks and minor cultivars in Southwestern China |
| *P. pseudopashia* Yu | Yunnan, Guizhou Provinces | Not used |
| *P. armeniacaefolia* Yu | Xinjiang | Not used |
| *P. ×phaeocarpa* Rehd. | Northern China | Minor cultivars in Northern China |
| *P. ×hopeihensis* Yu | Hebei and Shangdong Provinces | Rootstocks in Hebei Province |
| *P. ×serrulata* Rehd. | Changjiang River valley | Not used |
| *P. ×sinkiangensis* Yu | Xinjiang, Gansu and Qinghai Provinces | Cultivated in Xinjiang and Gansu Provinces |
| *P. ×bretschneideri* Rehd. | Changli County, Hebei Province | Formally referring to Chinese white pears; Not used |
| *P. ussuriensis* Maxim. | Northeastern China | Cultivated in North China and also rootstocks in Northeastern China |
| *P. pyrifolia* Nakai | Changjiang River Valley | Traditionally cultivated in Southern China, now also in Northern China; Rootstocks in Southern China |

**Figure 1. Over 200-year-old 'Lanzhou Dongguoli' in Lanzhou, Gansu Province (left) and 300-year-old 'Laiyang Cili' in Laiyang, Shangdong Province (right).**

## STATUS OF THE INDUSTRY

China has a long tradition of producing pears and the history of pear culture goes back at least 3000 years. Many of the pear cultivars originated hundreds of years ago are still widely cultivated in China and over 200- to 300-year-old pear trees are still productive in some areas of China (Fig. 1). In China, no other fruit is distributed as widely as the pear; pears are grown in almost all provinces except Hainan Province, which is in the tropical zone (Fig. 2).

The pear ranks third in the Chinese fruit industry after oranges and apple. China is the world leading country in pear production; in 2009 output was 14.4 million t with growing area of 1.26 million ha accounting for 65.7% of world production and 72.3% of world growing area. During the past decade, pear growing area increased by 27.7% and production increased 65.3% (Fig. 3). At present, the pear growing area in China has stabilized.

The relative importance of each province or region in pear production is shown in Figure 2. Over 75% of the total production comes from 9 provinces and regions. Hebei is famous for its 'Ya' pear and is also the leading pear production province in China and accounts for 18% of producing area and 26% production volume, followed in production by Shandong (8.8%), Liaoning (6.9%), Henan (6.5%), Shaanxi (6.3%), Sichuan (6.1%), Xinjiang (5.1%), Jiangsu (4.7%) and Anhui (4.6%).

During the past three decades, the distribution of pear cultivars in China has changed greatly. Late ripening cultivars have decreased from over 70% in 1978 to 55% in 2008, while early ripening cultivars have increased from 7% in 1978 to 18% in 2008 (Li, 2008). 'Suli' is the most important pear cultivar and comprises about

ers have proved that Chinese white pears are closely related to Chinese sand pears. Cultivars of Chinese white pear and sand pear might share a common progenitor species, wild *P. pyrifolia* (Teng et al., 2002; Bao et al., 2007, 2008; Zheng et al., 2008; Yao et al., 2010). Therefore, a new nomenclature has been proposed for Chinese white pears: *P. pyrifolia* Chinese white pear group (Bao et al., 2008).

According to countrywide investigations carried out in the 1950s and 1980s, there were over 3000 local pear cultivars (land races) distributed in China. Over 2200 accessions with representatives of at least 14 taxa mainly from China have been preserved in five National Pear Germplasm Repositories that were established in the 1980s: the largest are located in the Research Institute of Pomology, Chinese Academy of Agricultural Sciences, Xingcheng City, Liaoning Province and the Institute of Fruit and Tea, Hubei Academy of Agricultural Sciences, Wuhan City, Hubei Province. The three others are found in Jinlin, Yunnan and Xinjiang Provinces.

**Figure 2. Pear cultivation provinces and production in China in 2009 (data from Taiwan is not included).**

**Figure 3. Trend of pear planting area and output in China (1999-2009) (FAO).**

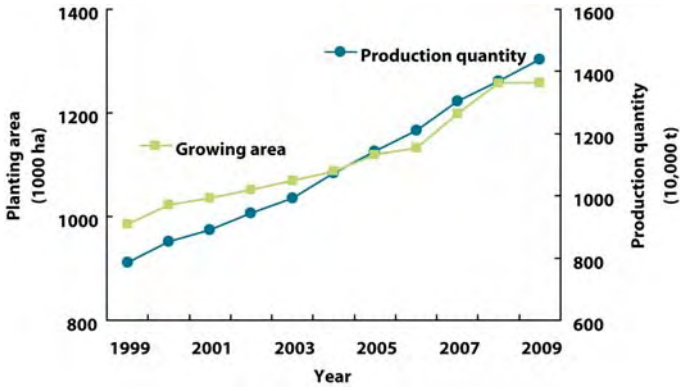



**Figure 4. Percentage distribution of pear cultivars to the total pear growing area in China (based on Li, 2008).**

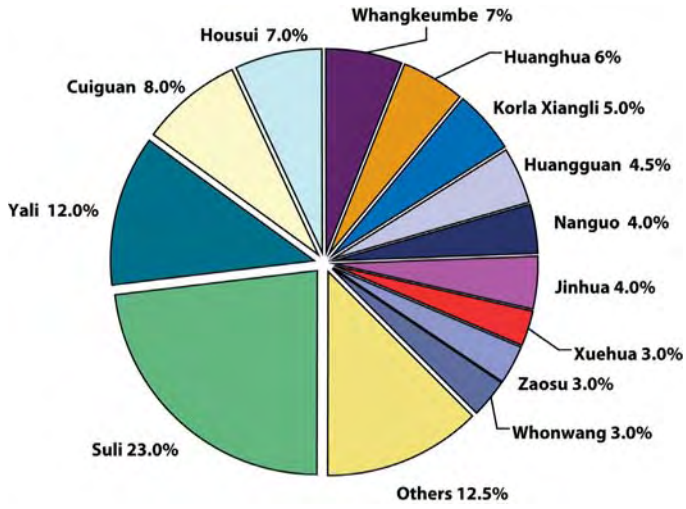



**Figure 5. Some important Chinese pear cultivars.**

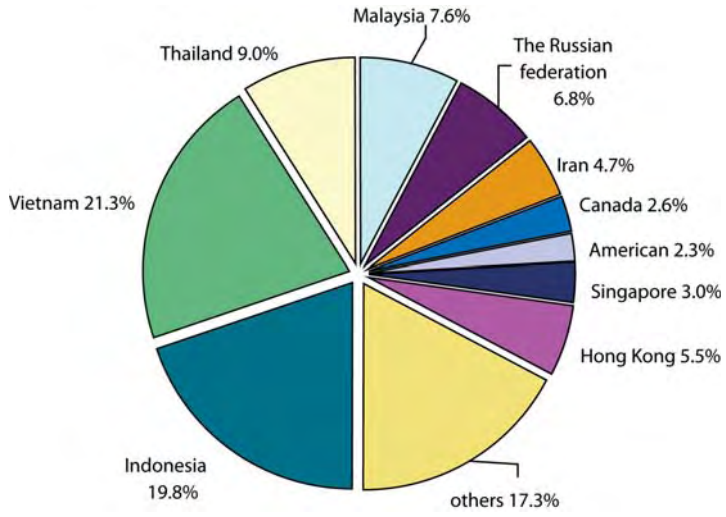

23% of the total production, followed by 'Yali' (or 'Ya' pear) (12%), 'Cuiguan' (8%), 'Housui' (7%), 'Nanguo'(4%), 'Huanghua' (5%), 'Whangkeumbae' (6%), 'Korla Xiangli' (5%) and others (Fig. 4). 'Suli' is mainly grown in Anhui, Shaanxi, Henan and Shanxi Provinces, 'Yali' in Hebei Province, 'Cuiguan' and 'Huanghua' mainly in Southern China, 'Housui' in Sichuan, Shandong and Jiangsu Provinces, 'Nanguo' in Liaoning and Jinlin Provinces, 'Whangkeumbae' in Shandong, Henan, Jiangsu and Sichuan Provinces, 'Korla Xiangli' in Xinjiang. There are also some pear cultivars with only local interest such as 'Lanzhou Dongguoli' in Gansu Province, 'Baozhu' in Yunnan Province, 'Laiyang Cili' in Shandong Province and 'Cangxixuli' in Sichuan Province. Some popular Chinese pear cultivars are shown in Figure 5.

Most of the pears in China are consumed fresh and only a limited quantity processed (Fig. 6). However, compared with 810,000 t in 2006, the processed pear fruit has increased to 1,100,000 t in 2009 (about 8.15% of total production), a 35.8% increase. This proportion is still low compared with that in Europe where 20% of total pear production is used for processing (Deckers and Schoofs, 2002). In the future, the proportion for processing will increase, which will influence the economic potential of pear industry in China. No specific cultivars have been developed for processing. Cultivars of *P. ussuriensis* are suitable for juice production because of their high contents of sugar and acids. On the other hand, European pear cultivars such as 'Bartlett' are generally used for canning.

Of the total pear production in China, 96.7% is consumed in the domestic market and only 3.3% is exported as fresh fruit. In 2009,

**Figure 6. Pear fruit is processed as juice, canning, and preserved fruit (provided by Prof. Wenhui Wang of the Research Institute of Pomology, Chinese Academy of Agricultural Sciences).**

**Figure 7. The top ten countries and regions that China exported pears to in 2009 (Ministry of Commerce of the People's Republic of China).**




China exported 462,800 t of fresh pears to other countries, which increased by 4% compared with the previous year. China exceeded Argentina and has become the first biggest pear exporter. As a return, China was paid $US 0.22 billion, which was 2% higher than in 2008. The export cultivars are mainly 'Yali' and 'Korla Xiangli'. The export price in 2009 was about $US 475/t. The top 5 export destinations in 2009 were Vietnam (21.3%), Indonesia (19.8%), Thailand (9.0%), Malaysia (7.6%) and the Russian Federation (6.8%) (Fig. 7). China exported 98,700 t of pears to Vietnam worth $US 28.35 million that accounted for 21% of the total quantity. In contrast to the situation of pear export, the pear import in China has continuously decreased from 633.5 t in 2000 to 9 t in 2008.

## CULTIVATION AND BREEDING

### Rootstocks, Planting Density, and Training Systems

Unlike European countries where clonal selections of Quince dwarfing rootstocks are extensively used, nearly all pear orchards in China are established on pear seedling rootstocks with a high vigor. Because of different climate and soil conditions, pear growers in different regions use different seedling rootstocks as shown in Table 1. Every kind of rootstock has its specific advantages and problems. *P. betulaefolia* and *P. calleryana* are dominant rootstocks used in North and South China, respectively. The former is a vigorous, good drought and cold-tolerant rootstock with good compatibility with different types of cultivars, but relative weak to lime-induced iron chlorosis. The latter is a moderately vigorous rootstock with good adaptability to hot and humid climate conditions. Other species are used as rootstocks regionally (Table 1). However, they may have specific traits for specific uses: *P. xerophila* has proved to be very tolerant to iron chlorosis (Ma et al., 2005) and *P. ussuriensis* is the cold hardiest of all *Pyrus* species and can endure -40 to -50°C.

Due to lack of dwarfing rootstocks, old pear orchards consisted of widely spaced trees (5-6×4-5 m). The trees were trained as large multi-leader or central leader trees (Fig. 8A). This training system delayed early fruiting. Recently established orchards tend to be more intensive with a between-row spacing of 4 m and a within-row spacing of 2 m. Trees are trained to small central leader tree forms (Fig. 8B) in North China and open-center tree forms in South China (Fig. 8C). Many measures such as girdling, shoot tying, bending, and the application of plant growth regulators to induce heavy loads of fruit in the early production stage are used to control excessive tree vigor in high density plantings. In South China, because of good water conditions during the summer, trees usually grow excessively, which is now leading to poor yield and quality with increasing tree age due to poor light distribution and penetration into tree canopy. Recently, the trellis pergola training system prevailing in Japan has been introduced into some areas of China, especially in Shandong, Jiangsu and Zhejiang Provinces. Most of the orchards with trellis training were modified from central leader trees in North China (Fig. 8D) or from open-center tree forms in South China. Because of high planting density (4×4 m) and low trunk height (40-50 cm), the tree form is very similar to Kansai style used in Kansai area in Japan decades ago. Most fruit-bearing shoots and branches are not tied to the trellis and stretched horizontally, but located under the trellis surface. This modified trellis pergola training form has not functioned as well as the original one in tree management.

**Figure 8. Different training systems: (A) large multi-leader or central leader form; (B) small central leader tree form; (C) open-center tree form; (D) trellis pergola training form (A and C were provided by Prof. Yuxing Zhang of College of Horticulture of Hebei Agricultural University.)**


### Pollination and Fruit Bagging

Pear has a gametophytic self-incompatibility (SI) system, where pistils cannot be fertilized with its own or genetically related pollen. Therefore, cross or artificial pollination is essential for pear production. In a pear orchard, every fourth or fifth row of commercial cultivar has another cultivar planted within the whole row to act as

**Figure 9. Artificial pollination is becoming more and more popular.**

a pollinator cultivar. A good pollinator should flower at the same time and have compatibility with commercial cultivars. Self-incompatibility is controlled by multiple alleles in a single *S* locus. Many studies have been carried out by Chinese scholars to identify *S* genotypes of Chinese pear cultivars. Until now, *S* genotype of more than 50 Chinese pear cultivars has been identified and 20 new *S* alleles have been isolated from Chinese white pears, Chinese sand pears, and Ussurian pears (Wuyun et al., 2005, 2007; Heng et al., 2007, 2008). These results will be of help to select suitable pollinator cultivars. In some pear growing regions, artificial pollination is becoming the usual practice in order to obtain fruit with excellent shape and good internal quality (Fig. 9).

Fruit bagging has become a conventional practice in pear cultivation for the production of high-quality fruit in China. Unlike Japan where only fruit of yellow-green-skinned (smooth) cultivars such as 'Nijisseiki' are bagged, both smooth and russet fruits of cultivars are bagged in China to improve visual quality and to prevent damage by diseases, pests, and birds, and also to protect fruit from direct contact of pesticides and fungicides. Recently, fruit bagging was used in red Chinese sand pears to improve fruit coloring. Fruit bagging at the early stage of fruit development and bag removal during the maturation period was proved to be effective in improving the visual qualities with high lightness and low hue angle (Huang et al., 2009).

### Pests and Diseases

The major diseases inducing economic losses on pear in the entire country are black spot (*Alternaria alternata*), scab (*Venturia nashicola*), rust (*Gymnosporangium asiaticum*), ring rot (*Physalospora piricola*) and anthracnose (*Colletotrichum gloeosporioides*). In some areas of North China, powdery mildew of pear (*Phyllactinia pyri*) has recently become a major concern. Until 10 years ago, fruit moths and fruit-piercing moths were important pests. However, extensive application of fruit bagging has decreased the damage of moths to pear trees in most pear growing regions in China. Chinese pear psylla (*Psylla chinensis*), aphids, spider mites, pear leaf-curling midge (*Dasineura pyri*) are still the most harmful pests threatening pear production. *Spodoptera litura* that did not damage pear trees in the past has become a dangerous pest in some regions. Besides the chemical control, pheromone mating disruption, yellow sticky traps and insect trapping lamps such as frequency trembler grid lamp are becoming more and more popular.

### Breeding

Modern pear breeding in China initiated in the Department of Horticulture of Zhejiang University and the Research Institute of Fruit Trees, Chinese Academy of Agricultural Sciences in the 1950s (Shen et al., 2002). Twenty years later, two institutions released a middle ripening cultivar 'Huanghua' and an early ripening cultivar 'Zaosu', respectively. Since then, many new cultivars have been successively released by means of seedling selection, bud mutation, induced mutation and cross breeding. Until now, at least 17 national and provincial institutions have been involved in pear breeding and more than 50 new cultivars have been released. Some of them have become the leading cultivars that have changed pear distribution in China. 'Huanghua' was once grown in 15 provinces with an area of 150,000 ha but only 55,000 ha remain. Other new important cultivars are 'Cuiguan', 'Huangguan', 'Zhongli No.1', and 'Xuqing'.

Until now, newly released cultivars have been based on the traditional breeding methods. Because regeneration systems for Asian pears are not well established, genetic engineering techniques have not been introduced in pear breeding programs. In the future, with the progress in molecular marker assisted breeding (Han et al., 2010), Chinese pear breeding programs can be expected to turn to biotechnology.

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## About the Author


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# Fruit Production in Poland

Andrzej A. Przybyla

Poland is first in production of currants and second in production of apples, raspberries and strawberries in the European Union. In the world production of fruits, Poland is second in currants, fourth in apples and raspberries, and seventh in strawberries.

## GEOGRAPHY AND CLIMATE

Poland is a country in Central Europe bordered by Germany to the west; the Czech Republic and Slovakia to the south; Ukraine, Belarus and Lithuania to the east; and the Baltic Sea and Kaliningrad Oblast, a Russian enclave, to the north. The total area of Poland is 312,679 km$^2$. Poland's territory extends across several geographical regions, between latitudes 49 and 55°N, and longitudes 14 and 25°E. Forests cover 28.8% of Poland's land area. More than half of the land is devoted to agriculture. While the total area under cultivation is declining, the remaining farmland is more intensively cultivated.

Poland has many different soils. Sandy formations occupy about 50% of the total area. Their water properties depend upon the depth of the ground-water table, substratum soil profile layers, and content of silt particles less than 0.02 mm in diameter. The main types of soils include swampy boulder loam, organogenic soils developed on peat, alluvial soils, silty and loess formations. Average quality of Poland's soil is fairly low. Only about 23% of arable soils may be considered good or very good (classes I-IIIb), while poorest soils (classes V-VI) account for over 30% of Polish cultivated land.

The climate is oceanic in the north and west and becomes gradually warmer and continental towards the south and east. Summers are generally warm, with average temperatures between 17 and 20°C. Winters are cold, with average temperatures around 3°C in the northwest and -6°C in the northeast. The warmest region is south-western Poland where temperatures in the summer average between 22 and 30°C, but can go as high as 32 to 38°C on some days in the warmest months of July and August. The coldest region of Poland is in the northeast, where the average temperature in the winter ranges from -6 to -4°C. The climate is affected by cold fronts that come from Scandinavia and Siberia. Late frosts occur in mid-May and early frosts occur from the beginning of October. Extremely cold winters with temperatures approaching -40°C occur every 10-15 years.

Precipitation falls throughout the year, although, especially in the east, winter is drier than summer. Average annual rainfall is 583 mm and in most regions of the country ranges between 500 and 600 mm. In smaller areas in the uplands and the mountains along Poland's southern border annual rainfall may reach as much as 800-1500 mm; Central Poland receives 450-550 mm; the coastal zone 500-600 mm. Two-thirds of annual rainfall occurs in the summer. Snow accounts for two thirds of winter (December-March) precipitation. The annual insolation ranges between 1600 and 2000 hours.

## PRODUCTION STATISTICS

Fruit production in Poland is complicated by large fluctuations in cropping due to variable climatic conditions. For example, severe spring frosts in 2007 were responsible for the lowest

**Figure 1. Structure of fruit area production in Poland.**

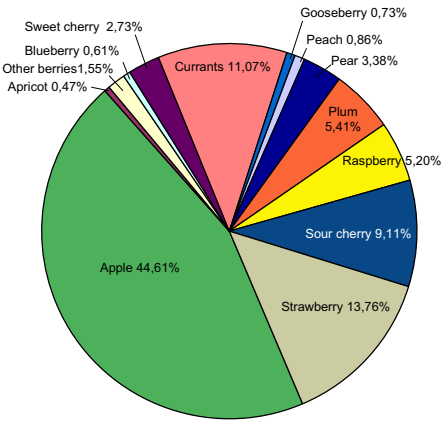


**Figure 2. Fruit production in Poland: (A) fruit trees; (B) apple; (C) berries; (D) strawberry.**

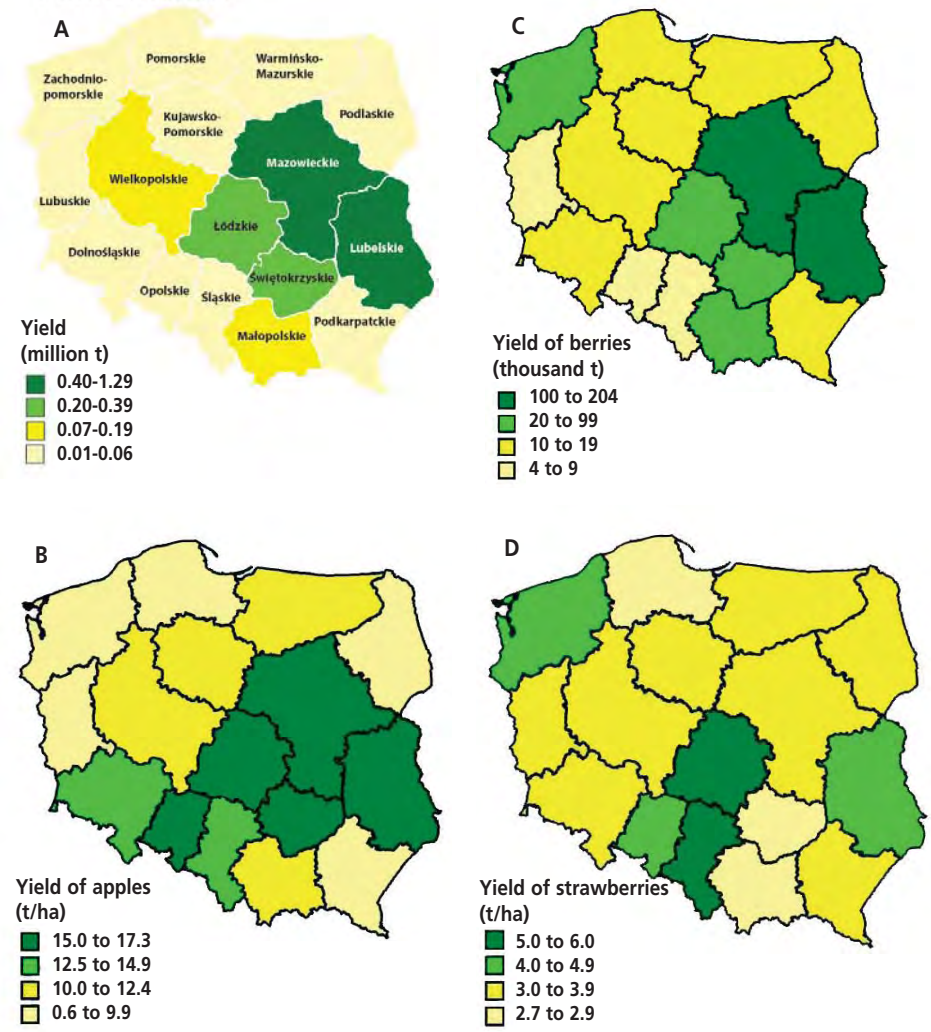

**Figure 3. Dwarf sweet cherry orchard** (courtesy of J. Lewko).

**Figure 4. Young trees of 'Ligol' apple on M.9 rootstock.**

fruit harvest in the last 20 years. As compared to 2006, apple harvest was 55% lower (only 1.2 million tons), 45% lower for sour cherry, and 25% lower for currants. Strawberries were the exception with only a 10% decrease. However, abundant yields were obtained in 2008 compared to 2007 with increases of 142% for apples, 82% for sour cherries, 40% for currants and 15% for strawberries. Crop instability has a strong influence on price fluctuations. In 2009, total fruit production was high (3.6 million t).

In Poland small orchards dominate with 77% less than 1 ha. Almost 50% of the orchard area is at least 5 ha, 34.5% is 7 to 15 ha, and only 0.25% is at least 20 ha. The most important fruit crops in Poland are apple and strawberry (Figs. 1 and 2). Annual production of apples is over 2 million t. In 2007 apple trees covered 66.5% of total fruit trees cultivation area, sour cherry 16.4%, plum 6.8%, sweet cherry 3.6%, pear 2.8%, with 3.9% for the remaining fruit crops.

In 2009, there were 173,600 ha of apple, a 1% increase over 2008. This compares with 35,500 ha for sour cherry, 21,000 for plum, 20,100 for walnut, 13,200 for pear, 10,600 for sweet cherry (Fig. 3), 3,400 for peach, and 1,800 for apricot. Area increases as compared to 2008 were 9.0% for apricot, 7.3% for sweet cherry, 5.6% for peach, 2.7% for walnut, and 1.0% for pear. However, there were decreases in sour cherry (2.0%) and plum (0.4%). Over the last 10 years fruit crops areas have been generally stable with some losses of apple area and increases in other fruit crops.

In 2009, total fruit production was high amounting to 3,646,300 t, and was only 194,500 t lower (5.1%) than the record harvest in 2008. Because of the mild 2008/2009 winter there was an increase of diseases and pests. Apple production of 2,626,300 was 7.2% lower than in 2008 while production of sour cherries was 189,200 t (6.2% lower), plums were 120,700 t (6.3% higher), pears 83,000 t (14% higher), sweet cherries 50,500 t (23.7% higher), peaches 12,500 (3.6% higher), apricots 12,400 (27.9% higher), and walnut 12,400 (7.3% higher). Production of sour cherries in 2009 would have been record-breaking if all fruits would have been harvested but because of very low harvest profitability, only part of the crop was harvested. Irrigation systems were found in 7.8% of orchard area. The highest share of irrigated area is in larger orchards, 10 to 20 ha, where 20% is irrigated. About 20% of fruit crops are irrigated in orchards of 20 to 50 ha.

In 2007, 62% of apples were used for fresh consumption, and 38% were processed. For the other fruits the percentage was as follows: pear, 79% for fresh consumption, 21% for processing; and sweet cherry, 86% for fresh consumption, 14% for processing. In sour cherry and raspberry about 80% of fruits, and the majority of gooseberry and currant (over 90%), were processed.

Changes in orchard technology are leading to intensification of production. The size of trees is diminishing, with increasing number of trees per unit area. In apple there is an increase in area of orchards on dwarfing rootstocks and a decrease in the number of cultivars. For berries, with the exception of strawberry, there is an increase in cultivated area, especially for blueberry.

## APPLE AND PEAR

Cultivation of apple is concentrated mainly in the center of Poland, in the territory of Mazowieckie province (around 40% of apple area). A large concentration of apple orchards is also found in Lubelskie, Łódzkie, and Świętokrzyskie. These four provinces contain 76% of Poland's apple.

About 56% of apple orchards are on semi-dwarf rootstocks. The majority of trees on dwarfing rootstocks are in orchards younger than 10 years (73%). This constitutes 19% of total apple orchards area. Cultivation of apple on vigorous rootstocks is decreasing, but still amounted 25% in 2007.

Apple density has been increasing. Generally for 4-year-old orchards, there are 1,373 trees/ha, and for dwarfed trees there are 1,647 trees/ha. About 45% of apple orchards have 800 to 1599 trees per ha. This compares to 35% for pear.

The apple cultivar structure has been stable for many years. The largest share in cultivation area still has 'Idared' (16.1%), followed by 'Jonagold' (11.5%), 'Šampion' (10.2%), and 'Cortland' (8.6%). Some cultivars have been increasing such as 'Jonagold', 'Šampion', 'Gala' and 'Ligol' (Fig. 4) while some older cultivars have declined such as 'Jonathan' and 'Spartan'.

In pear, three cultivars dominate: 'Conference', 25.9% of total (Fig. 5), 'Clapp's Favorite' and its red mutant, 24.7%, and 'Beurré Alexander Lucas', 21.2%.

## BERRIES AND NUTS

In 2009, total production of berries was 546,300 t, 1.3% lower than in 2008. Small decreases of production were observed for the majority of berry crops, with the exception of raspberries and blueberries. In 2009, the cultivated area of both crops was higher than in 2008,

**Figure 5. 'Conference' pear on quince MC** (courtesy of J. Lewko).

**Figure 7. Fruit blueberry plantation** (courtesy of T. Sobczak).

but lower for other berry crops. Production of raspberries in comparison to the mean of 2001 to 2005 increased over 60%. Strawberry production (Fig. 6) was 198,900 t, 0.9% lower than in 2008 as compared to currants, 196,500 t (0.1% lower), raspberries 81,800 t (0.3% higher), chokeberries 36,800 t (17.8% lower), gooseberries 15,800 t (2.3% lower), blueberry 11,000 (40.3% higher), and hazelnut 3,100 t (11.0% lower).

The strawberry area in 2009 was 53,600 ha, 1.1% lower than in 2008. This compares to black, red and white currents (43,100 ha), raspberry (20,200 ha), chokeberry (5,100 ha), gooseberry (2,800 ha), blueberry (2,400 ha), and hazelnut (2,700 ha). In comparison to 2008, increases in cultivated area was observed for blueberry (4.9%) (Fig. 7) and raspberry (1.3%). For currant, chokeberry, gooseberry and raspberry 4-year-old and older plantations dominate. For strawberry, about 75% of the area are plantations younger than 4 years, and for blueberry about 60%.

## NURSERY PRODUCTION

There is a decrease in the area of fruit nurseries. In 2010, the total area was 815 ha, as compared to, 861 ha in 2009 and 916 ha in 2008. The number of nurseries is also declining with 462 in 2010, 507 in 2009, and 549 in 2008. The total production of apple rootstocks was 32.7 million in 2010 with the highest share to M.26 (9.4 million), followed by M.9 (7.0 million), M.9T337 (3.2 million), M.7 (2.9 million), P 14 (2.5 million), P 60 (2.3 million). There has been an increase of M.9 and M.9T337 production, with similar production of M.26, M.7 and P 60, and a decrease of P 14. Vegetatively propagated fruit tree rootstocks comprise 23.8% of the total area of nurseries while strawberries occupy 14.2%.

**Figure 6. Large strawberries** (courtesy of R. Glinicki).

## FURTHER READINGS


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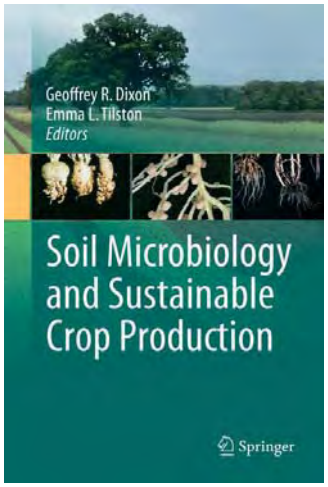
# New Books, Websites

## BOOK REVIEWS

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

**Soil Microbiology and Sustainable Crop Production. Geoffrey R. Dixon and Emma L. Tilston (eds.). 2010. Springer, Dordrecht, Heidelberg, London, New York. 436p. ISBN 978-90-481-9478-0 (hardcover). $209 / 149.95 €. www.springer.com**




*Soil Microbiology and Sustainable Crop Production*, edited by Geoffrey R. Dixon and Emma L. Tilston, provides a succinct overview of the complex inter-relationships between beneficial soil microbes and crop plants, and highlights the potential for utilization of these relationships to enhance crop productivity and environmental health. Soil microbes have long been known to play a key role in agricultural systems, regulating important factors such as decomposition of organic matter and nutrient cycling. However, for much of the past century, agricultural scientists and practitioners have focused primarily on plants, and direct management of the soil microbial community for the benefit of sustainable crop production has largely been ignored. The goal of this book is to address this deficiency by reviewing both the current knowledge regarding the role of soil microbes in agricultural systems, as well as where future progress in this area is likely to have a positive impact on the productivity and sustainability of these systems.

The book begins with a chapter entitled 'The nature of sustainable agriculture' by A.D. Noble and S. Ruaysoongnern, which provides an overview of common factors associated with sustainable production to put the subject into context. The second chapter 'The microbiology of natural soils' by T.C. Balser, D. Wixon, L.K. Moritz and L. Lipps, provides a baseline for how soil microbial communities have been impacted by agricultural management by summarizing what is known about microbes in natural systems. Subsequent chapters entitled 'Soil microbiology and nutrient cycling' by D.W. Hopkins and J.A.J. Dungait, and 'The role of microbial communities in the formation and decomposition of soil organic matter' by L. Condron, C. Stark, M. O'Callaghan, P. Clinton and Z. Huang, focus on the role of microbes in nutrient cycling and decomposition of organic matter, demonstrating how these activities can be managed for the benefit of sustainability objectives. Next, intimate associations between both beneficial and pathogenic root-associated microbes are reviewed in chapters entitled 'Intimate associations of beneficial soil microbes with host plants' by O.Y. Shtark, A.Y. Borisov, V.A. Zhukov, N.A. Provorov and I.A. Tikhonovich and 'Soilborne pathogens and their interactions with the soil environment' by G.R. Dixon and E.L. Tilston, followed by a discussion of how specific management practices influence these complex interactions in 'The impact of land - use practices on soil microbes' by E.L. Tilston, T.P. Sizmur, W. Otten and J.A. Harris. Opportunities for interaction between plant breeders and plant pathologists are the subject of the two succeeding chapters entitled 'The effects of plant breeding on soil microbes' by P. Marschner and Z. Rengel, and 'Utilizing soil microbes for biocontrol' by A. Stewart, M. Brownbridge, R.A. Hill and T.A. Jackson, which discuss the impact of selection conditions on beneficial plant-microbial interactions and opportunities for utilizing microbes for biocontrol of important plant pathogens. Finally, the potential impacts of climate change on soil microbes and the important implications of their management on economic and social constraints facing practitioners are discussed in 'How will climate change impact soil microbial communities?' by T.C. Balser, J.L.M. Gutknecht and C. Liang, and 'Evaluating the economic and social impact of soil microbes' by H.S. Sandhu, Vadakattu V.S.R. Gupta and S.D. Wratten.

The editors, Dixon and Tilton, have succeeded in putting together a work that outlines the important role for soil microbes in sustainable crop production systems. The well-written book assembles an impressive list of international experts in the field of soil science to illustrate this concept, and clearly demonstrates that research in this area is critical for the development of effective and sustainable crop production strategies. The final chapter by H.S. Sandhu, Vadakattu V.S.R. Gupta and S.D. Wratten is of particular importance, as it is geared towards policy makers whose support is essential for obtaining the resources necessary to conduct research in this vital area. This collection is ideal for graduate and post-graduate students interested in delving into the largely unexplored realm of soil microbes in agricultural production systems, as well as seasoned agricultural research scientists and policy-makers interested in new approaches that bridge multiple disciplines to develop production systems that are truly sustainable.

Reviewed by Lori A. Hoagland,
Purdue University, USA

**Caravaggio: Still Life with Fruit on a Stone Ledge. Aaron H. De Groft (ed.). 2010. College of William & Mary, Williamsburg, Virginia, USA. 169p. ISBN 978-0-9705725-6-1. $32.95+postage.**


This stunning, beautiful book is based on a symposium held at the Muscarelle Museum of Art at the College of William & Mary held November 9 and 10, 2006 entitled *Natura Morta Still Life Paintings and the Medici Collection.* The book contains seven scholarly papers presented on the second day and an extended introduction by Aaron H. De Groft, Director of the Muscarelle Museum. All the chapters revolve around a single painting entitled *Still Life with Fruit on a Stone ledge* probably painted in 1603 by the Baroque master painter Michelangelo Merisi, known as Caravaggio (1571-1610). The chapters include: Caravaggio and the Origins of Roman Still Life Painting (John T. Spike); The Final Insult: Caravaggio, Baglione, and Still Life on a Stone Ledge (John L. Varriano); Caravaggio in the Garden of Priapus: The Academic, Semiotic, and Poetic Contexts of Still Life with Fruit on a Stone Ledge (Adrienne

von Lates); The Fruits of Still Life with Fruit on a Stone Ledge (Allen J. Grieco); Caravaggio and the Mottetti del Frutto of Antonio Gardano (John T. Spike); Caravaggio's Fruit: A Mirror on Baroque Horticulture (Jules Janick); and The Commemorative, Polemical, and Satirical Contexts of Still Life with Fruit on a Stone Ledge (Adrienne von Lates). The work, a combination of art history and horticulture, contains extensive footnotes, an extended bibliography, and 94 illustrations.

## NEW TITLES

González Torres, Dionisio. 2009. Catálogo de Plantas Medicinales (y Alimenticias y Utiles) Usadas en Paraguay. (Catalog of Medicinal Plants). Servilibro, Asunción, Paraguay. 476p. ISBN 99925-859-6-X (hardcover). www.servilibro.com.py

Keenan, Mary L. 2011. That Hard Hot Land. Botanical Collecting Expedition in the Anglo-Egyptian Sudan. 1933-1934. Published by Mary L. Keenan. 416p. ISBN 978-0-9564910-0-8 (hardback). £52. Available from marykeenan44@hotmail.com

Latin, Richard 2011. A Practical Guide to Turfgrass Fungicides. APS Press, St. Paul, MN, USA. 280p. ISBN 978-0-89054-392-4 (hardcover). $139.95. www.apsnet.org

Lespinasse, Jean-Marie and Leterme, Évelyne (eds.). 2011. Growing Fruit Trees: Novel Concepts and Practices for Successful Care and Management. W.W. Norton & Company, New York, NY, USA. 352p. ISBN 978-0-393-73256-6 (paperback). $49.95. http://books.wwnorton.com

## WEBSITES

www.iospress.nl/loadtop/load.php?isbn=18785093: The Journal of Berry Research is a quarterly peer-reviewed publication by IOS Press that focuses on four main areas of research and development: from genetics to variety evaluation; nursery productions systems and plant quality control; plant physiology, biochemistry and molecular biology and culture management; and health for consumers (components and factors affecting the nutritional value of berries). The journal covers berries (strawberry, cranberry, bilberry, blueberry, etc.), as well as grapes and small soft fruit in general (e.g., kiwi fruit). It publishes research results covering all areas of plant breeding, including plant genetics, genomics, functional genomics, proteomics and metabolomics, plant physiology, plant pathology and plant development, as well as results dealing with the chemistry and biochemistry of bioactive compounds contained in such fruits and their possible role in human health. Contributions detailing possible pharmacological, medical or therapeutic use or dietary significance are welcomed in addition to studies regarding biosafety issues of genetically modified plants. The journal features reviews, research articles, brief communications, position papers, letters and patent updates.

# 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 Course on Greenhouse Horticulture / Curso Internacional de Horticultura Protegida, 29 August – 2 September 2011, Celaya City, Guanajuato, Mexico. Info: www.horticulturaprotegida.com

59th International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research, 4-9 September 2011, Antalya, Turkey. Info: Özge Tağizade, FTS Tourism, Hilal Mahallesi 4. Cadde 65/10 Yıldız, Çankaya, Ankara, Turkey, Phone: +90 312 439 68 04-05, Fax: +90 312 439 68 02, Email: ozge@ftsturizm.com, Web: www.ga2011.org

30th International Vegetable Training Course "Vegetables: From Seed to Table and Beyond", 12 September - 2 December 2011, Bangkok, Thailand. Info: AVRDC - The World Vegetable Center, Regional Office East & 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

International Conference on Innovations in Extension and Advisory Services: Linking Knowledge to Policy and Action for Food and Livelihoods, 15-18 November 2011, Nairobi, Kenya. Info: Email: extension2011@cta.int with a copy to info@fara-africa.org and info@g-fras.org, Web: http://extensionconference2011.cta.int

Advanced Course on Use of Remote Sensing for Irrigation Management, 21-26 November 2011, Zaragoza, Spain. Info: Mediterranean Agronomic Institute of Zaragoza (IAMZ) – CIHEAM, Avenida Montanana 1005, 50059 Zaragoza, Spain, Phone: +34 976 716000, Fax: +34 976 716001, Email: iamz@iamz.ciheam.org, Web: www.iamz.ciheam.org

Regional Symposium: High Value Vegetables in Southeast Asia: Production, Supply and Demand, 24-26 January 2012, Chiang Mai, Thailand. Info: Dr. Grisana Linwattana, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand, Email: sym-veget@hotmail.com, Web: www.seaveg2012.com

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

International Master of Fruit Science, Bozen-Bolzano, Italy. Info: Prof. Massimo Tagliavini, Faculty of Science and Technology, Universitätsplatz 5 - piazza Università 5, 39100 Bozen-Bolzano, Italy, Phone: +39 0471 017000, Fax: +39 0471 017009, Email: science.technology@unibz.it, Web: www.unibz.it/sciencetechnology

# First Int'l Medicinal and Aromatic Plants Symposium

The First International Medicinal and Aromatic Plants Symposium (IMAPS) and the Second Iranian Phytochemistry Seminar (IPS) were held in Shiraz University in the presence of Iranian experts and guests from Hungary, India, Pakistan, the United States and some African countries during June 21-24, 2010. Members of the Executive Committee of the symposium would like to thank ISHS for supporting this effort. They were Dr. Morteza Khosh-Khui, member of National Academy of Sciences of the Islamic Republic of Iran and distinguished professor emeritus of Shiraz University, Dr. Paul Kostecki, Executive Director of AEHS Foundation and professor of the University of Massachusetts, and Dr. Jalal Ghaemghami, a Visiting Research Scholar at Harvard School of Public Health and President of the SHMEN Inc. Dr. Ghaemghami served as the convener and director of both events. Staff was directed by Dr. Jamal Saharkhiz who successfully guided the operation and assured high level participation of local, national and international participants. The event would not be possible without his professional and energetic leadership of the local committees, operation, and site management. Dr. Saharkhiz also produced a high quality booklet that included most of the abstracts, specifically those in Traditional Medicine and Plant Sciences. Dr. Saharkhiz is a member of the faculty at the Shiraz University and directs medicinal plant research projects at the institution.

This symposium was aimed to expand and advance culture of investigation and research on medicinal plants. It introduced the latest findings of the scientific investigations on medicinal plants and traditional medicine use of them. It documented the latest advances in industry and policy, clinical applications of medicinal plants, breeding, pests and diseases, ecology, chemistry and biochemistry, physiology, systematic and biosystematics, biotechnology and genetic engineering, and also pharmacology and pharmacognosy, clinical studies using the medicinal plant products, and the new approaches in utilizing medicinal plants in medicinal sciences. Shiraz Medical University supported sessions of the symposium related to medicine that were overseen by Dr. Alireza Salehi, while Dr. Amir Reza Jassbi directed phytochemistry seminars.

In the opening ceremony of this symposium in Velayat Hall of Shiraz University of Medical Sciences, Dr. Mohammad Moazzeni, Chancellor of the Shiraz Medical University, welcomed honorable guests from government organization and provided information about recent advances in horticultural sciences and collaborations between his university and horticultural schools. In his remarks, use of 300,000 different plant species in Iranian culture was described. He added, "Fortunately, in our country [Islamic Republic of Iran] plant variety is considerable due to the diversity of climatic conditions of different zones. Out of 14 recognized climatic types all over the world, 11 types exist in Iran and the plant species existing in Iran are more than all species existing in all of Europe." He ended his remarks by noting that "economic circulation of medicinal plants in the world has been estimated about 12 billion dollars in 2008 and it is predictable that this figure will reach into 50 billion dollars in year 2050."

The second distinguished speaker was the Chairman of the Agricultural Organization of Fars Province who was followed by Professor Dr. Akos Máthé, Chair of the ISHS Section Medicinal and Aromatic Plants. Dr. Munir Ozturk also delivered his speech and thanked

Registration desk.

Opening ceremony. From left: Drs. Khosh-Khui, Ozturk, Máthé, Ghaemghami, Moazzanie, Kherad, Saharkhiz, Jehad and Ebrahimi.

supporting organizations and universities. Finally, Dr. Jalal Ghaemghami welcomed guests as the Director of the symposium. In his concise speech, he paid respect to the late leader of Horticulture Sciences of Islamic Republic of Iran, Professor Dr. Reza Omidbaigi who supported the event for two years and unfortunately died the night before the opening ceremony. During the second day three keynote speeches were delivered by Dr. Ozturk, the honorable Dr. Rustaiyan father of Phytochemistry in Iran, and Dr. Máthé. The guest speakers Dr. S.D. Purohit, Dr. R. Tareen along with Dr. M. Khosh-Khui and Dr. H. Rajaee provided informative talks during the event.

Over 100 students provided their research findings while 20 professors of the Iranian universities delivered oral presentations. Over 50 manuscripts were submitted for review and are being processed for publication in a volume of *Acta Horticulturae* during 2011. The editorial group for the publication includes Dr. Morteza Khosh-Khui, Dr. Jamal Saharkhiz, and Dr. Jalal Ghaemghami.

Student participants supported facilitation of the event and were recognized for their efforts during a ceremony at the start of the second day of the event. Dr. Máthé and Dr. Ghaemghami presented them with a letter of appreciation on behalf of ISHS and the Executive Committee. On behalf of the sponsoring companies, supporting universities, executive and scientific committees, the convener would like to thank students at Shiraz University for conducting all operations and facilitation of both events. Our special thanks are offered to Lic. Razieh Khajehyar and Dr. Mostafa Khoshhal-Sarmast for managing the student staff in operation and facilitation. The organizers would also like to thank Dr. Lyle E. Craker for his leadership and valuable support.

**Student staff, Dr. Máthé, Dr. Saharkhiz and site managers at closing day of the symposium.**


Razieh Khajehyar and Mostafa Khoshhal-Sarmast

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Section Ornamental Plants

# Second Int'l Symposium on Genus *Lilium* (SYMPLITALY2010)


**Participants of SYMPLITALY 2010.**

The 2nd International Symposium on Genus *Lilium*, SYMPLITALY 2010, was held in Pescia (PT), Italy, from August 30 to September 3, 2010, under the aegis of the ISHS, Section Ornamentals Plants, Working Group Flowerbulbs and Herbaceous Perennials, and of the Italian Society of Horticulture (SOI), Section Floriculture and Ornamental Plants. Local organiser was the CRA-VIV Unità di Ricerca per il Vivaismo e la Gestione del Verde Ambientale ed Ornamentale (Landscaping Plants and Nursery Research Unit) of Pescia, Italy. The Symposium gave to the

Co-Convener Antonio Grassotti presenting the SYMPLITALY 2010 plate to invited speaker Barbara Ruffoni (left) and the SOI (Italian Society of Horticulture) Award of Recognition to Mark Roh (right) for his research activity on lily.

participants the opportunity to exchange and discuss new results and approaches, with the common concern to promote research and practical work with *Lilium*. The Symposium brought together about 80 scientists from all over the world. People came from 22 different countries. Three days were devoted to scientific presentations, which included 8 invited keynote lectures, 24 oral presentations and 45 posters, and one day to the Technical Tour.

A wide range of topics was discussed covering botany, genetics, breeding, propagation, physiology, agronomy, pathology, and quality and postharvest management.

The Opening Ceremony started with a welcome address by Dr. Antonio Grassotti, Co-Convener of the Symposium with Dr. Gianluca Burchi, who extended his thanks and gratitude to the participants and to the members of the Editorial Board and the Scientific and Organizing Committees. Following the Opening Ceremony, a representative of the Italian Ministry of Agriculture, Food and Forestry Policies and of the CRA, the President of the Province of Pistoia and the Mayor of the Town of Pescia greeted the participants. Later, Dr. Paolo Inglese and Dr. Margrethe Serek presented the activity of the SOI and the ISHS Section Ornamental Plants, respectively.

The plenary lecture on *"Bulbs and cut flowers production in the genus Lilium: current status for the future"* was presented by Antonio Grassotti, Director of the CRA-VIV Pescia. In the Botany session, Iain Brodie of Falsyde, Auchgourish Botanic Garden, Scotland, UK, gave a keynote lecture on *"Revision of sections in the genus Lilium"*. Because of a serious surgical procedure following an accident a few weeks prior to the Symposium, Iain could not attend SYMPLITALY 2010, but he effectively delivered his presentation to the audience by means of an internet video-connection. Ten scientific oral and poster works were presented in the session.

In the Agronomy session, Dr. Jeung Keun Suh, from the Department of Environmental Horticulture, Dankook University, Korea, gave a keynote presentation on *"Systematic strategies of lily bulb production and forcing in Korea"*. Three oral presentations and 9 posters were also included in this session.

The keynote lecture *"Biotechnology and molecular breeding in lilies - Dreams and reality"* in the Genetics session was presented by Dr. Avner Cohen, from the Department of Ornamental Horticulture, Institute of Plant Sciences, ARO, the Volcani Center, Bet Dagan, Israel. Four orals and 5 posters were introduced during this session. Just in the day of his presentation, Avner concluded his prestigious career becoming officially a "retired scientist", but it's sure that he will keep on carrying out his research activities and improving knowledge in the field of genetics and breeding in the next years!!

Dr. Mark S. Roh, from the USDA, ARS, Floral and Nursery Plants Research Unit, Beltsville, MD, USA, presented the keynote lecture *"Controlled flowering in the genus Lilium - Past achievements and research direction for the future"* in the Physiology session, including also 3 oral presentations and 4 posters.

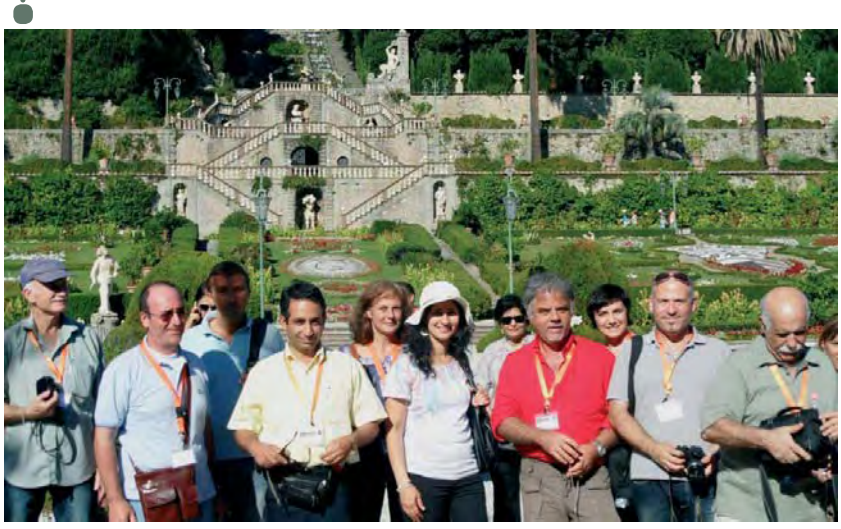
In the Breeding session, Dr. Jaap M. van Tuyl, from WUR, Plant Breeding, Wageningen, the Netherlands, presented a keynote lecture on *"Lilium: breeding history of the modern cultivar assortment"*. Four oral and 5 poster presentations were also given in this session.

Dr. Wouter van Doorn, from the Mann Laboratory, Department of Plant Sciences, University of California, Davis, USA, presented the keynote lecture *"Postharvest quality of cut lily flowers: a survey"* in the Postharvest session, in which 5 oral presentations and 5 posters were also introduced.

In the Pathology session, Dr. Roger H. Lawson, now retired but still active following a long and prestigious career at the USDA, ARS, Floral and Nursery Plants Research Unit, Beltsville, MD, USA, presented a keynote lecture on *"Detection, diagnosis and control of lily diseases"*. Six scientific presentations were given in this session.

Dr. Barbara Ruffoni, from the CRA-FSO Research Unit for Floriculture and Ornamental Species, Sanremo, Italy, presented her keynote lecture

Technical tour: visit to Villa Garzoni's Garden (left) and Pescia's Flower Market (right).



*"Strategies for Lilium propagation: tradition vs. biotech"* in the Propagation session, with 8 other scientific oral and poster presentations.

On September 2 the participants had the opportunity to visit the Flower Market of Pescia (the 2nd most important in Italy) in the early morning, and to participate to the Technical Tour including the visit of the Tintori Farm (ornamental *Citrus* nursery production and *Esperidarium* Collection), the Franchi Farm (Bonsai nursery production and Museum) in Pescia, the Butterfly House and the historical garden of Villa Garzoni in Collodi, the village of the world-wide famous puppet Pinocchio.

In the afternoon, the participants visited the CRA-VIV Research Unit in Pescia. On that occasion, Dr. Mark S. Roh received an "Award of Recognition" from the President of the SOI, Section Floriculture and Ornamental Plants, Dr. Stefania De Pascale, for his contribution to understanding the physiology of the genus *Lilium*. Later, Dr. Rina Kamenetsky presented the interesting art program "Ornamental geophytes in floral imagery of the Taj Mahal".

During the visit to the CRA-VIV, the participants also voted for the organization and location of the next Symposium: the 3rd International Symposium on Genus *Lilium* will take place in Pennsylvania, USA, and the chairman will be Dr. W. Bill Miller. The day ended with the social dinner, in a typical Tuscan medieval atmosphere that involved all participants.

The International Scientific Committee of SYMPLITALY 2010 was composed of:

A. Cohen (Israel) – ARO, The Volcani Center

B. De Lucia (Italy) – University of Bari

S. De Pascale (Italy) – University of Naples Federico II, Portici

**Co-Conveners Antonio Grassotti and Gianluca Burchi receiving the ISHS award. From left to right: Wouter van Doorn (Chairman of the ISHS Working Group Quality of Ornamentals), Jaap Van Tuyl (Editorial Board member), Margrethe Serek (ISHS representative), Bill Miller (Editorial Board member), Antonio Grassotti and Gianluca Burchi.**

M. De Vecchi (Italy) – University of Turin

S. Fukai (Japan) – Kagawa University

M.E. Giorgioni (Italy) – University of Bologna

R. Kamenetsky (Israel) – ARO, The Volcani Center

R. Lawson (USA) – Research Plant Pathologist – retired

K.B. Lim (S. Korea) – Kyungpook National University

C. Pasini (Italy) – CRA-FSO, Sanremo

V.P. Pelkonen (Finland) – University of Helsinki

B. Ruffoni (Italy) – CRA-FSO, Sanremo

J. Shii (China) – Nanjing Forestry University

J.K. Suh (S. Korea) – Science Dankook University

W. van Doorn (USA) – University of California, Davis

The Conveners wish to thank the Organizing and Scientific Committees, who kindly took charge of the running of this Symposium, and the staff involved in preparing the various events of SYMPLITALY 2010. Moreover, our special thanks go to the sponsors whose generous financial supports have contributed to the success of SYMPLITALY 2010, particularly the Italian Ministry of Agriculture, for its generous contribution to the printing of the Proceedings of the Symposium that will be published as a volume of *Acta Horticulturae*. Copies of the proceedings will be available from ISHS.

Antonio Grassotti and Gianluca Burchi

## Contact

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Section Pome and Stone Fruits – Commission Plant Protection

# Twelfth Int'l Workshop on Fire Blight

**Attenders of the Workshop.**

The 12th International Workshop on Fire Blight was held in Warsaw (Poland) from 16 to 20 August 2010. The workshop was organized by Research Institute of Pomology and Floriculture (RIPF), Skierniewice, Poland, in cooperation with Cost Action 864 "Combining traditional and advanced strategies for plant protection in pome fruit growing", under the auspices of ISHS. Dr. Marek Sawicki, Minister of Agriculture and Rural Development of Poland, provided the honorary patronage. The workshop was attended by 129 people from 34 countries. During the opening ceremony short welcoming comments were presented by: Dr. Marian Zalewski, Undersecretary of State, Ministry of Agriculture and Rural Development, Poland, Prof. Danuta Goszczyńska, Director of RIPF, Dr. Chris Hale, Chair of ISHS Commission Plant Protection and Representative of ISHS, Prof. Małgorzata Mańka, President of the Polish Phytopathological Society and Representative of the Polish Academy of Sciences, Dr. Virginia Stockwell, Convener of the former Workshop in Portland, Oregon, USA and Prof. Piotr Sobiczewski, Convener of this Workshop. The Crystal Apple, the highest award of the Director of RIPF, was awarded by Prof. Goszczyńska to colleagues with long outstanding careers in the field of fire blight research: Prof. Klaus Geider, Dr. Chris Hale, Prof. Maria Hevesi, Prof. Hikmet Saygili, Prof. Sherman Thomson, Dr. Virginia Stockwell, Prof. Wolfgang Zeller and Dr. Nico van Opstal. The Introductory Session of the workshop hosted a lecture of Dr. Nico van Opstal, Director General of EPPO, on "EPPO's future emphasis: prevention or eradication?". The workshop program consisted of 8 sessions; altogether, 118 lectures and posters were presented. Traditionally, besides oral and poster presentations, one day was dedicated to visits to orchards and nurseries in Central Poland. It allowed the participants to get acquainted with the main problems of Polish fruit producers with special attention to fire blight. In Poland, the disease occurs irregularly both from a regional and seasonal point of view and its importance in nurseries is negligible. The field session concluded with facility tours and presentations at the RIPF in Skierniewice.

Visit to fruit tree nursery in Lewiczyn near Grojec.

Typical bacterial ooze on apple terminal shoot.

## DIAGNOSTICS

This session was chaired by Maria M. Lopez (IVIA, Valencia, Spain) and Joanna Puławska (RIPF, Skierniewice, Poland). Ring test evaluation of various techniques for fire blight diagnosis and *Erwinia amylovora* detection, carried out by researchers from 15 countries, were presented as well as the results on validations performed in frame of the Euphresco ERWINDECT project. A new EPPO and IPPC scheme, consisting of a combination of different methods (molecular and serological) for maximum accuracy was described. Several reports were devoted to new rapid diagnostic tools. The core genes that are likely to be absent in other bacterial species, were determined by analyzing *E. amylovora* pan-genome, and will be studied as potential targets for development of molecular based diagnostic tests. MALDI-TOF analyses (based on protein profiles) showed perfect agreement with PCR results. Using a two-hour loop-mediated isothermal amplification (LAMP) assay made it possible to detect a single flower colonized by *E. amylovora* in a sample of 100 flower clusters. A lateral-flow immunographic strip (Ea AgriStrip) and real-time PCR also allow rapid detection with little or no interference from non-target microflora. Emission of specific volatiles (i.e. ethylene, NO, methyl jasmonate) during early infection stages of apple tissue can provide early diagnosis on asymptomatic material. Measurement of changes in chlorophyll fluorescence signals were presented as a non-destructive method for detection of *E. amylovora* in pear leaves. To detect the closely related pathogen *Erwinia pyrifoliae*, a species-specific PCR-based method along with a dot-blot hybridization assay were developed.

## GENOMICS

Brion Duffy (ACW, Wädenswil, Switzerland) and Pablo Llop (IVIA, Valencia, Spain) chaired this session. Among the several aspects presented, the evolutionary relatedness of significant features including virulence factors between *E. amylovora* and closely related species were highlighted. Core genome of *Erwinia* was estimated as a group of 2474 genes, whereas genes coding for small unknown proteins specific to *E. amylovora* were found. High similarity in several regions of different plasmids of *E. amylovora* also was shown. Advances in research on *E. amylovora* host plants genomics were reported in a session chaired by Cesare Gessler (SFIT, Zurich, Switzerland) and Mickael Malnoy (FEM IASMA, S. Michele all'Adige, Italy). Results from the *Malus* cultivar 'Golden Delicious' genome sequencing project reveals that many resistance genes are present in comparison to other plant species, and some of them are likely responsible for resistance to fire blight. Studies utilizing functional genomics and transcriptomic analysis showed new potential fire blight resistance genes or genes differentially expressed during infection by *E. amylovora*.

## BIODIVERSITY

The Biodiversity session was chaired by Klaus Geider (JKI, Heidelberg, Germany) and Tanja Dreo (NIB, Ljubljana, Slovenia). Even though the strains of *E. amylovora* are considered highly homogenous, results from analysis of SNP in *gal*E gene, CRISPR (clustered regularly interspaced short palindrome repeats), MLVA (multilocus variable number of tandem repeats analysis), and plasmid content were able to show some differences among *E. amylovora* populations and discriminated among some North American and European strains. Analysis of single nucleotide polymorphism of *gal*E allowed for differentiation of *E. amylovora* strains originating from fruit trees and raspberry.

## PATHOGENICITY AND VIRULENCE

Two sessions were devoted to pathogenicity and virulence of *E. amylovora*. One chaired by George Sundin (MSU, East Lansing, USA) and Youfu Frank Zhao (University of Illinois, Urbana-Champaign, USA), and the second one by Marie-Anne Barny (INRA, Paris, France) and Jay Norelli (USDA-ARS, Kearneysville, USA). Papers presented dealt with the role of *hrp* genes in pathogenesis – *hrp*L and *hrp*A in natural flower infection process, and *hrp*N in type III translocation and callose deposition. Analysis of *hrp* gene cluster showed that Japanese *Erwinia* is more similar to *E. pyrifoliae* than to *E. amylovora*. The complexity of plant-bacteria relationship was underscored by results from the analysis of amylovoran biosynthesis, of altered biofilm formation by genes encoding flagellar motor stator and the increased virulence deriving from the newly discovered plasmid pEI70.

**Heavy infection of pear tree through blossoms.**

## EPIDEMIOLOGY

This session was chaired by Sherm Thomson (USU, Salt Lake City, USA) and Elena Biosca (VU, Valencia, Spain). From the presentations, it emerged that biocontrol and induction of resistance may be complementary methods to support to current strategies of fire blight management. However, new threats for the spread of the pathogen include the Mediterranean fruit fly (medfly) (*Ceratitis capitata*), an effective vector of the pathogen to fruits and leaves, and the ability of *E. amylovora* to infect and colonize host plants through roots, suggesting irrigation water can play an important role in dissemination. Recently, RIMpro-erwinia computer model was developed to address the host effects by simulating bacterial growth and the possibility of infection during blooming. Preliminary data suggest that the model can improve blight prediction as compared to Cougarblight and Maryblyt. On the other hand an updated and simplified version of the first one referred as Cougarblight EZ also indicates increase of its accuracy. The more effective recovery of viable but not culturable (VBNC) cells in planta compared to culture media or immature pear fruits supports the hypothesis of VBNC state as a part of the pathogen life cycle, which provides clues both from epidemiological and control aspects. The unsettling information of the first natural outbreak of the disease on stone fruits in Europe was reported: an apricot cultivar 'Velharda' orchard in Czech Republic was severely damaged by *E. amylovora*.

## BREEDING FOR RESISTANCE

Markus Kellerhalls (ACW, Wädenswil, Switzerland) and Andreas Peil (JKI, Dresden-Pilnitz, Germany) chaired the session focussing on breeding new apple and pear genotypes with high resistance not only to fire blight but also to apple scab and powdery mildew. In Switzerland, marker-assisted breeding for fire blight was successfully established by using two SCAR-markers and two promising selections ACW 14995 and ACW 14959 were obtained. *Malus sieversii* (fire blight resistant) is often used for crossings. Ring trials performed at RIPF Skierniewice (Poland) and JKI in Dresden (Germany) with about 40 cultivars and clones originating from 6 European countries revealed that those generally scored as highly resistant or highly susceptible reacted in the same manner independent of location and inoculation procedure. Studies on transformed lines of 'Galaxy' showed an increased level of resistance to fire blight. Morphological features of apple and pear genotypes also seem useful as potential markers for resistance to disease. A new resistance bio-assay using an in vitro culture technique of shoot tips also was proposed.

**Fire blight necroses around leaf veins.**

## BIOLOGICAL CONTROL

This session consisted of two parts: the first was chaired by Maria Hevesi (CU, Budapest, Hungary) and Joel Vanneste (IPFR, Hamilton, New Zealand) and the second by Virginia Stockwell (OSU, Corvallis, USA) and Wolfgang Zeller (IBC, RKI, Berlin, Germany). The introductory lecture was devoted to changes and success in the implementation of biocontrol against fire blight. Several products based on bacteria and yeasts, demonstrating various mechanisms of action, are registered and in some countries already introduced into practice. Strains of *Pantoea agglomerans* (*P. vagans*) are the most commonly utilized, but new species (e.g. *Pseudomonas graminis*) have also been identified. A strategy using Blossom Protect (*Aureobasidium pullulans*) and Myco-sin (sulphuric clay minerals, deactivated yeast components, extracts from horsetail) was developed to control fire blight and apple scab in organic fruit production. For this purpose, yeast and bacteria based products integrated with lime sulfur and fish oil also were considered. Other effective strategies include the integration of biocontrol products applied during blossom with induction of resistance by using prohexadione calcium during shoot growth, and using essential oils and metabolites of antagonistic bacteria, as well as application of nematodes and *E. amylovora* phages.

## CHEMICAL CONTROL AND RESISTANCE INDUCTION

The first part of this session was chaired by Karl Stich (TU, Vienna, Austria) and Ken Johnson (OSU, Corvallis, USA), while Tom Deckers (PC Fruit, Sint Truiden, Belgium) and Lech Michalczuk (RIPF Skierniewice, Poland) chaired the second. The studies presented show an increased array of molecules able to control fire blight: natural plant constituents with comparable activity to streptomycin, non-protein amino acids that are more inhibitory than streptomycin, and Kasumin (aminoglycoside antibiotic

kasugamycin) in a mixture with a biocontrol agent or oxytetracycline to delay development of resistance of *E. amylovora* to streptomycin. Some of these compounds suppressed pathogen biofilm formation. Various copper formulations with or without mancozeb were effective against the pathogen and phytotoxicity varied among copper compounds: Cu-sulphate showed highest toxicity while Cu-oxychloride showed the lowest. Laminarin extracted from seaweed and applied to pear and apple trees reduced their susceptibility not only to fire blight but also to apple scab. Acibenzolar-S-methyl (Bion) used as single drench on potted young pear trees dramatically slowed and then stopped development of fire blight cankers. New avenues for developing control products are arising from the discovery that phytoalexins (biphenyls such as aucuparin and dibenzofurans such as eriobofuran) are synthesized after infection by *E. amylovora*. Two novel strategies considering secondary metabolites also were presented: one is based on inhibition of flavanone 3-hydroxylase (similar effect as prohexadion calcium) and the second on changes related to dihydrochalcone.

At the end of the workshop, Prof. P. Sobiczewski was elected as the new Chair of the Working Group on Fire Blight and Dr. Brion Duffy was elected as Secretary and Convener of the 13th International Workshop on Fire Blight to be held in 2013 in Zurich, Switzerland. The 12th International Workshop on Fire Blight continued the tradition that began 33 years ago in Wageningen (The Netherlands) and provided a forum for discussion on the latest developments in all aspects of research on fire blight and the bacterium *E. amylovora*. Much progress has been made during the 3 years since last workshop in Portland, USA, excellently organized by Virginia Stockwell and Ken Johnson. The Local Organizing Committee would like to thank the Nobell Congressing for outstanding help as well as several organizations, including Ministry of Agriculture and RIPF Skierniewice, for sponsorship.

Piotr Sobiczewski and Joanna Puławska


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Section Vegetables – Commission Plant Protection

# Third Int'l Symposium on Tomato Diseases

Group of participants at the 3rd ISTD.

The 3rd International Symposium on Tomato Diseases was held on 25th-30th July 2010 in Ischia (Naples), in Italy. The Symposium was organized under the auspices of the International Society for Horticultural Science (ISHS), University of Basilicata (UNIBAS), the Italian Society of Plant Pathology (SiPAV), the Italian Society of Plant Protection (AIPP), the Italian Society of Nematology (SIV) and the Italian Horticultural Society (SOI), and under the patronage of Basilicata and Campania Regions, the Province of Potenza and the Italian Ministry of Agriculture and Forestry. The Symposium was also co-sponsored by several companies: Rijk Zwaan, Bioagritest, Biotechseed, ISI sementi, Dupont, Bayer, Belchim, Syngenta, Tris International, Isagro, Clause Vegetable Seeds.
150 participants from 30 different countries

Professor Crescenzi, Convener, and Dr. Silvana Nicola, Chair ISHS Section Vegetables.

applied for this Symposium in Ischia, to represent Europe, Asia, North and South America, Africa and the Middle East. During the 5 days, 68 oral and 60 poster presentations were presented. Tomato industry, diseases of tomato caused by fungi, viruses, bacteria, and nematodes, disease resistance, abiotic stresses and disease management were the main sessions of the 3rd International Symposium on Tomato Diseases. The about 130 scientific presentations represented the most recent advances in diseases of tomato. Representatives of the Italian Ministry of Agriculture and Forestry and of Campania Region have made a fundamental contribution to the conference and honored us with their presence.

Tomato is a widely cultivated crop in the world for the production of fruits both for fresh consumption and for processing. In 2008, the world production of tomatoes was 130 million tons, of which 28% was processed by tomato industry for tomato paste and other products. The long and ancient tradition of growing tomato has helped tomato to become one of the typical Italian products and has encouraged the export of "Made in Italy" in the world.

The main objective of the Symposium was to promote, among researchers of the public and private institutes, the exchange of information about recent research developments on diseases of tomato and the protection of tomato crop from diseases. It was a very important event, useful to exchange new methodologies and knowledge on pathogens infecting tomato and their control. As social activities, a welcome cocktail was given at the Congress venue, Hotel Continental Terme, on July 25th, 2010. An amazing guided tour through the most beautiful places of the Island of Ischia took place on Wednesday 28th, organized by the Organizing Committee, as well as a farewell dinner to all participants at the Restaurant of the Hotel.

Professor Crescenzi, who was the Convener of the Symposium, would like to thank all the people who were nearby, who contributed to the success of the Symposium and all public and private companies that, with their contributions and financial support, helped to facilitate the participation of many scientists. Moreover, he would like to thank everyone for the effort to take part in the Symposium and for the considerable contribution given to its success, with the hope that the charming and unique natural scenery of the Bay of Naples was enriched by new knowledge and has enabled new networking opportunities among participants for a long term cooperation and collaboration.

Aniello Crescenzi


## Contact

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# Tenth Int'l Conference on Grapevine Breeding and Genetics

Nearly 200 attendees of the X International Conference on Grapevine Breeding and Genetics gathered for the official group photo on Tuesday, 3 August 2010, prior to a tour of Cornell and USDA research facilities.

The X International Conference on Grapevine Breeding and Genetics was welcomed to the Finger Lakes region of New York by researchers representing Cornell University (New York State Agricultural Experiment Station), the USDA-Agricultural Research Service, and the University of Guelph (Ontario, Canada). The meeting took place 1-5 August 2010, followed by a post conference tour 5-7 August 2010. Nearly

200 scientists and students from 21 countries attended the Conference, which took place in modern facilities on the campus of Hobart and William Smith Colleges, Geneva, New York. The meeting was organized under the auspices of the ISHS Working Group on Grape Vine Genetics and Breeding and the Section Vine and Berry Fruits.

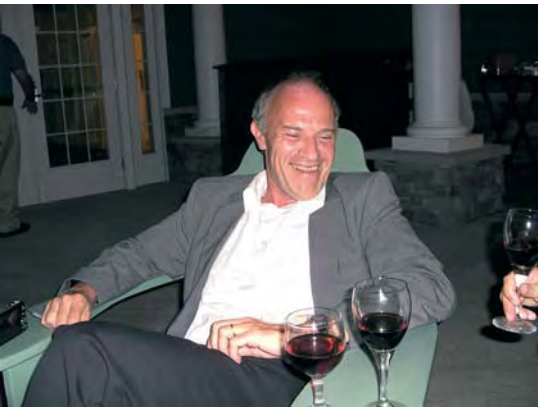
The welcoming reception for participants took place in the historic Smith Opera House. Attendees enjoyed the opportunity to meet with each other and to enjoy Finger Lakes wines with a selection of local foods. A short program included welcoming speeches from the following individuals: Ben Ami Bravdo (former Chair of the ISHS Section Vine and Berry Fruits representing ISHS); Tom Burr (Director of the New York State Agricultural Experiment Station and Associate Dean of Cornell's College of Agriculture and Life Sciences); Dariusz Swietlik (Area Director, North Atlantic Area, Agricultural Research Service, U.S. Department of Agriculture); Stu Einstein (Mayor, City of Geneva); and James Trezise (President, New York Wine & Grape Foundation). Conference Convener Bruce Reisch (Professor of Grapevine Breeding and Genetics, Cornell University) also welcomed participants and presented a history of grapevine breeding and genetics research at the New York State Agricultural Experiment Station, Geneva, New York.

Participants enjoyed oral presentations, posters, and professional tours over the next four days. There were a total of 159 papers presented (4 invited keynote presentations, 55 oral presentations, and 100 posters).

On day one, Ian Dry (Principal Research Scientist, CSIRO, Australia) kicked off the meeting with an enthusiastic presentation entitled "Recent progress in understanding the genetics of pest and disease resistance in *Vitis*". Day one sessions covered "Pest and Disease Resistance" in the morning, a most active area of research, and excellent progress was reported. The early afternoon session focused on poster presentations covering the following subjects: Berry Quality; Adaptation to Soils and Climates; Genomics, Transcriptomics, Proteomics, and Metabolomics; and Transgenic Research. The final oral session of the day covered "Grapevine Breeding: Techniques, Goals, and Strategies". Dr. Rudolf Eibach (Julius Kühn-Institut, Germany) gave an invited presentation on "Progress in Grapevine Breeding", which set the stage for the many talks that followed. There was an excellent mixture of presentations on day one on applied progress in cultivar development as well as the underlying progress in understanding grapevine molecular genetics in support of breeding efforts.

**Peter Cousins and Heidi Schwaninger explain activities at the USDA-ARS collection of cold-hardy grapevine germplasm.**

**Dr. Bernd H.E. Hill, Weinsberg, Germany, relaxes during the conference banquet. Dr. Hill has attended more of this series of meetings than any other 2010 participant, having attended the Second International Symposium held in Bordeaux, France, 1975, and every meeting since.**



In 2007, two groups announced the publication of the genome sequence of *Vitis vinifera*. At the conference, it was most exciting to see that much of the progress anticipated by the sequencing of the genome is quickly being realized. Dr. Anne-Françoise Adam-Blondon (INRA, France) led off the second conference day with a keynote presentation entitled "Grapevine Genome Update and Beyond". Numerous talks followed on the subjects of Genomics, Transcriptomics, Proteomics, and Metabolomics.

Following lunch, participants boarded buses for a tour of Cornell and USDA research projects at the New York State Agricultural Experiment Station. There was ample opportunity to visit the USDA cold-hardy grapevine germplasm collection, as well as the Cornell grape breeding program, plus viticulture research on new varieties and selections from the Cornell program. The weather was warm and sunny, and after both lab and field visits, the group enjoyed an old-fashioned barbecue dinner and wine reception at the recreation fields at the Experiment Station. Attendees enjoyed the opportunity to relax, have informal discussions, and share experimental wines from breeding programs as well as commercial samples from many countries.

On Wednesday, August 4, Anne Fennell (South Dakota State University) delivered the final invited presentation, "Genetics and genomics of grapevine responses to abiotic stress", making a complex topic understandable for all. Oral sessions that day covered Abiotic and Biotic Stress Resistance, Genetics of Fruit Quality, and Transgenic Research. Poster sessions that afternoon covered Grapevine Germplasm - Conservation and Analysis; Breeding Techniques, Goals, and Strategies; and Pest and Disease Resistance.

Late in the afternoon, participants boarded coaches to visit selected wineries of the Finger Lakes district of New York. Owners and winemakers presented their perspectives on the regional wine industry, as well as the range of native, hybrid, and vinifera varieties in use. Following the winery visits, the coaches delivered attendees to the Harbor Hotel, Watkins Glen, overlooking Seneca Lake, for a banquet featuring local wines made from vinifera, hybrid (including Cornell hybrid) and native grapes. Everyone danced to the tunes of the "Cool Club" and its jazz fusion style while enjoying the friendly atmosphere.

On the final conference day, there were numerous excellent oral presentations on Grapevine Genetic Resources - Parentage, Population Genetics, Fingerprinting, as well as Breeding for Quality. Dr. Bravdo ran a brief business meeting during which it was decided that the next con-

From left to right: Bruce Reisch, Andy Walker, and Chin-Feng Hwang enjoy a light moment together during tours of research plots.

ference in this series would be hosted in Beijing, China, with Max Cheng (Univ. of Tennessee and Nanjing University) as the conference convener. Ernst Rühl was re-elected as Chair of the Working Group on Grapevine Breeding and Genetics.

The gathering of this group of researchers provided the opportunity to convene additional related meetings. Prior to the start of the conference, the Second Annual Meeting of the Grapevine Research Coordination Network took place from 30 July to 1 August, in an NSF funded effort to foster collaboration in grapevine genetics research worldwide. In addition, the Grapevine Crop Germplasm Committee (advisory to the USDA-ARS) and the Steering Committee of the International Grapevine Genome Program held meetings during the conference.

Some participants departed for home following the conclusion of the meeting, while about 50 stayed for an educational and enjoyable post conference tour, led by Peter Cousins (Geneticist, USDA-ARS Grape Genetics Research Unit) along with Tim Martinson and Hans Walter-Peterson of Cornell Cooperative Extension. Visits were organized to unique area vineyards (Keuka Lake district and Rochester region) with an evening dinner overlooking Keuka Lake. On the final day of this tour, all enjoyed a visit to Niagara Falls, including a boat ride in the gorge to the base of the falls.

We look forward to reuniting with our colleagues from around the world in Beijing, 2014!

Bruce I. Reisch and Peter S. Cousins

## Contact

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Commission Landscape and Urban Horticulture

# First Int'l Symposium on Urban and Peri-Urban Horticulture in the Century of Cities

Participants of the Symposium.

The First International Symposium on Urban and Peri-Urban Horticulture (UPH) in the Century of Cities held on 6-9 December 2010 in Dakar, Senegal attracted more than 200 participants from 39 countries of Africa, America, Asia and Europe. The symposium was convened and jointly organized by the Government of Senegal and FAO Plant Production and Protection Division under the auspices of ISHS. The symposium covered key links in the production, supply and value chains and it was organized into 5 plenary sessions:

- Session 1: The impact of urbanization and the role of UPH
- Session 2: Characterization of urban and peri-urban agriculture
- Session 3: Measuring the contribution of UPH to urban food supply, nutrition, income generation and livelihoods
- Session 4: Management of natural resources and waste for UPH
- Session 5: Safeguarding food quality and safety and growers' health, safety and welfare

The symposium in itself was a great success for the many participants who attended but also for the variety of issues addressed: 18 stands with different life displays of local and regional partners that have engaged in UPH-related activities; 26 posters; 8 keynote presentations; 20 oral presentations in plenary sessions; 16 seminars/workshops on subject matter specialities (48 presentations) and 3 technical tours (micro-gardens; horticulture training college; seed company). There were also a couple of round table discussions on specific topics that needed to be debated. The symposium also provided information on the UPH's contribution to urban food supply, nutrition and livelihoods and it laid down the foundations for increased policy and institutional support and networking for UPH. The symposium also gave the opportunity to share with participants the preliminary status report on urban and peri-urban horticulture (SOUPHA) based on the survey study conducted prior to the Dakar meeting.


**Panelists of the Closing Session. From left to right: Wilfried Baudoin, Gert Gröning, Jacky Ganry, Margaret Pasquini, Megan McGlinchy, Norman Looney, Sy Gaye, NeBambi Lutaladio and Neveen Metwaly.**

The official opening ceremony was honoured by the presences and communications of the Prime Minister of Senegal, HE Souleymane Ndene Ndiaye; the Assistant Director General-AG of FAO, Mr. Modibo Traoré; the Mayor of the City of Dakar, Mr. Khalifa Sall; the Mayor of the City of Milan, Ms. Letizia Moratti; the President of the Horticulture Inter-professional Association of Senegal, Mr. Cheikh Ngane. Their respective communications highlighted the strong political commitment to UPH at central, decentralized and professional levels.

The keynote presentation of Dr. Norman Looney, Immediate Past President of ISHS and Chairman of the Global Horticulture Initiative, on "The place for urban and peri-urban horticulture in feeding the urban poor: Researchable issues for horticultural science" set the scene for the symposium, highlighting the values of UPH and the key constraints. A key message from the presentation is that UPH for food and income security is a fact of life in thousands of towns and cities around the world.

Other important statements made during the symposium include:

- UPH has been forever a reality. Interventions consist of upgrading it from an informal status to a fully acknowledged sector of activity that plays a key role in urban food and nutrition security, employment and income generation for the low income families.
- UPH must not be addressed in isolation, it should be considered as a pillar of city planning and included in strategies to feeding the growing urban population of the developing countries of the world.
- The urban population will continue to expand. This requires political decisions and strategies to make best use of city space and water resources and integration of UPH in the city master plans.
- UPH is absent from training and research programmes; it is important to include UPH in training curricula and in the process of developing research strategy.
- There is a need to develop methodology tools to collect information and to agree on indicators and parameters to characterize UPH and allow for more visibility and monitoring of future progress or regression.

**An urban horticulturist.**

- UPH contributes to the achievement of the 8 MDGs.
- Production within the urban and peri-urban environment facilitates access to fresh fruits and vegetables and reduces post-harvest losses significantly.
- Urban Horticulture within cities reduces the heat island effect by evapo-transpiration and improves the air quality through the photosynthesis process by absorbing $CO_2$ and releasing $O_2$.
- Rooftop gardens lower the building temperature and allow saving on energy for cooling.
- Lack or weak pesticide-use regulations and control.
- UPH contributes to in situ conservation of plant biodiversity.
- UPH symposium should be organized on a regular basis (3/5 years) to assess the impact of interventions.

The symposium concluded with a plenary session during which participants made concrete recommendations for future interventions. The proceedings of the symposium will be published in a special issue of *Acta Horticulturae*. Overall, the aim of the symposium to foster lively debate and dialogue between participants was achieved. Feedback during the closing session indicated that participants were extremely satisfied with the outcome of the meeting and they are looking forward to the opportunity to meet in the Second International Symposium on UPH.

Rémi Nono-Womdim and Ababacar Sy Gaye


## Contact

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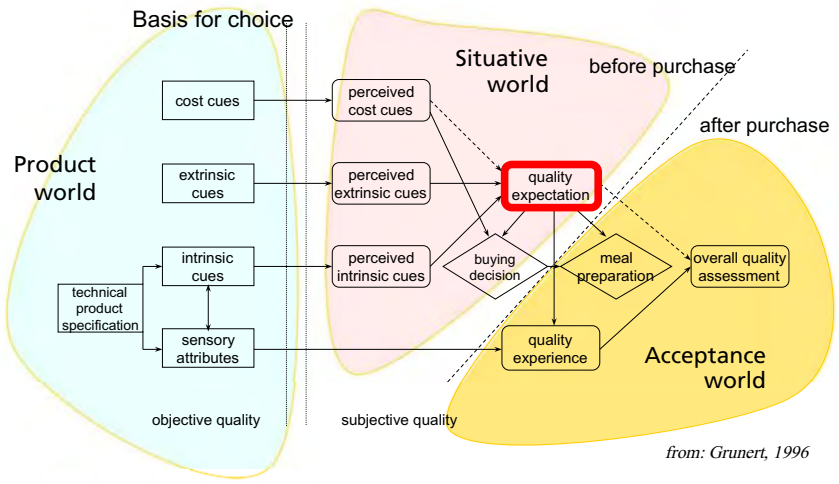
Ababacar Sy Gaye, Director of Horticulture, Ministry of Agriculture, Dakar, Senegal, email: sygaye@yahoo.fr


# IHC2010 Workshop 12 - What Do We Mean by Quality?

During the 28th International Horticultural Congress in Lisbon last August, 26 workshops were held. These were informal meetings with the opportunity for broad and unconstrained exchange on novel or more reflective topics. The workshop "What do we mean by quality?" was organized by Silvana Nicola, VEGMAP-Agroselviter, Università di Torino (Italy), Chair of the ISHS Section Vegetables, and Bernhard Brueckner, Institute for Vegetable and Ornamental Crops (Großbeeren, Germany), Chair of the ISHS Working Group Vegetable Quality. More than 60 scientists attended the event to hear and discuss the vegetable quality view in present and future horticultural research: what do we measure? – what does the market measure? – what does the consumer measure? Four speakers opened the event and presented aspects of horticultural quality research, examples of success and shortcomings from different perspectives.




**Basis for choice.** Redrawn by Brueckner under permission of Klaus G. Grunert.

## PREDICTABILITY

An important aspect of fruit and vegetable quality was addressed by Olaf van Kooten from the Horticultural Supply Chains group at Wageningen University (The Netherlands): consumer relevant quality cannot be assessed from a single fruit or vegetable organ. The biological variation, be it caused by genetic or environmental differences, makes it necessary to assess quality in batches. The intensity of a quality attribute is not a figure but a distribution, which has to be considered when planning to meet consumer or consumer segments' expectations. Consumers are demanding and prefer expectable and constant quality. Theoretical and real-world studies were able to demonstrate that up to 50% higher prices were accepted, when delivered quality was as expected.

## JUST IN TIME

Most of the quality attributes of fruit and vegetables are not only inhomogeneous, but also change with time after harvest in a characteristic way. Colour of tomatoes moves during ripening from green to red and firmness decreases steadily. Consumers differ in their preference for tomato attribute intensities. As studies have shown, there are distinct segments of tomato consumers preferring attribute combinations corresponding to distinct stages of ripening. Smart postharvest management takes the variation and the development into account, controls environmental conditions and speed of distribution to deliver fruit in the desired stage or in a previous stage for consumption days after purchase.

## SMART PRODUCTION

Smart, model based logistics may not only upgrade distribution, but also production processes. After having analysed crop data since

1994, the group of "plantlab" researchers in 's Hertogenbosch (The Netherlands) and Wageningen (The Netherlands) managed to distil and compile all essential growth and quality formation patterns. In combination with economic calculation models, new automation techniques and artificial LED-lighting, together with 56 combinations of environment parameters to affect plant development, could be varied and researched simultaneously. Among them are light intensity, light colour, relationship between colours, room, crop and root temperature, $CO_2$ content and air humidity. Besides efficient and flexible production one idea behind is to customise quality in terms of taste, composition, appearance among others.

## QUALITY DURING MINIMAL PROCESSING

This is a positive example for a comprehensive research coverage across interfaces in the supply chain. But often it is still anything but granted, that produce differences brought by the production systems are dealt as an important input factor in postharvest research, as reported by Silvana Nicola from the University of Torino (Italy). Also pre-harvest studies, successful to improve cultivation practice, yield and general product quality, often fail to incorporate specific needs of a selected final destination, e.g. processing. In other words, there is a commitment to quality, but the quality criteria are not tuned enough to the specifications of the next customer and even less to further steps in the supply chain towards the consumer.

Diversity, convenience and also health profits serve the requirements of consumers. This is probably the reason for the economic success of fresh-cut with a business volume of 200-900 M € per year in many of the European countries. Quality research concentrates on innovative technologies, spoilage control, safety, knowledge regarding physiological processes and prolonged shelf life. But when it comes to improved flavour, freshness, appearance, taste, nutritional content and consumer oriented quality premium the scientific activity is sparse.

## LOGIC OF PRICING

To tailor quality attributes according to consumer demands is an important vehicle to increase consumer satisfaction, repeated purchase and higher margins. Pricing, however, is only partly connected to quality differentiation, as Wojciech Florkowski from the University of Georgia (USA) explained in his presentation. At farm and wholesale level, higher prices are possible, when the preferred attributes of the following customers – which usually are not final consumers – are met. At retail, especially in supermarket chains, pricing rather is based on the retailer's objectives to maximize the return on sales of all items, not necessarily for fresh vegetables only.

## INDIVIDUAL PREFERENCES USED FOR COMPARATIVE ADVANTAGE

Consumer's choices are based on her/his set of preferred attributes and income. The valuation of attributes differs, the objectives of all buyers do not perfectly overlap. Therefore, market pricing shows inefficiencies, giving opportunities for gain. Possible gain always motivates "businesses" to search for attributes creating a comparative advantage.

**Diversity of fresh convenience food available** (Photo S. Nicola).


HEALTHY DIVERSE CONVENIENT

**Fresh and organic convenience meal at the airport of Munich, Germany** (Photo S. Nicola).

## ECONOMIC BENEFITS OF QUALITY RESEARCH

Suitable attributes are selected and serve to enable a market gain. Scientific research benefits quality in quantifiable, measurable attributes. This kind of progress accelerates the use of scientific results to differentiate products and suppliers. Individual groups or associations also actively request scientific research on specific quality attributes with the intention to use the results to gain comparative advantage, thus increasing revenue and/or market share.

## CREDENCE ATTRIBUTES ARE A SEPARATE QUALITY CATEGORY

Quantifiable attributes may influence rational decisions but relevance to consumers is diverse. Apple colour e.g. is a required attribute in apple trade, but consumers generally ignore its volume when buying apples. How could colour intensity units then be converted into their monetary value?

But there are more attributes with increasing valuation by consumers: health related attributes, conventional or organic growing, use of genetic modification and social or environmental standards as well as the details and distance of growing region. Some of them are also used as cues like those which they recognize at and around the product, e.g. appearance, colour, size, visible structure, firmness to the touch, packaging and the information on it. These cues are called credence attributes and help to infer and assess attributes, which cannot be experienced directly before purchase (flavour) or even after consumption. Credence

**Fresh and organic ready-to-eat salads at the airport of Munich, Germany** (Photo S. Nicola).

attributes are used like measurable attributes, to extract higher prices from consumers.

## FADE OF IMPACT

With repeated purchase and consumption, personal experience becomes more important than the indirectly assessed credence qualities. What remains after repeated consumption is the liking of direct sensory impressions. This gradual loss of quality dimensions may become a disadvantage, especially for products where a high proportion of extrinsic, credence quality is involved (e.g. functional foods). Two theses can be concluded from this fact:

- External information must be repeated, renewed or modified, innovative product attributes must be developed and emphasised
- Intrinsic, sensory attributes must meet the preferences

## MEETING EXPECTATIONS IS THE KEY

The usual argument for in the food industry to involve consumer preference data is the fact that flop rate of new products is very high, especially when consumer acceptance was not sufficiently tested. "Are flops with fruit and vegetables something we have to be aware of?" is the question Bernhard Brueckner from the Institute for Vegetable and Ornamental Crops (Großbeeren, Germany) raised. Of course this is not the typical case, but there is a new uncertainness brought by new varieties of exotic fruit and vegetables, new sizes, mixtures, new functional properties and postharvest technologies. All of them can have considerable impact on the sensory profiles - necessary to know whether they are acceptable or not.

## SUPPLY AND VALUE CHAIN

Supply chain approach underpins the information flow from the consumer throughout all supply steps. But there is a strong focus on supply rather than the actual use of the product, the future needs and the trade off between wanting and therefore giving up alternatives. Thus, the focus shifts to value and choice of the most valued. Consumers assign highest value to food that meets their sensory preference. Sweetness, juiciness, crispness, pungency, bitterness, colour and texture are the important attributes of fruit and vegetables that define consumer segments, which differ in their preferences.

## LIFESTYLE DEPENDENT VALUATION

Credence and intrinsic attributes affect choices as do the societal, personal or situational requirements. Among the important drivers of consumer choices are cultural (tradition, food rules), health sensitive (allergies, functional effects, personal nutritional demand, risk perception), attitude (neophobia vs. curiosity, chefs vs. amateurs, regional, exotic, authentic) and operative factors (convenient, shelf life, maturity, usability). Addressing these requirements inevitably leads to an enormous diversification and opens the opportunity to launch new ranges of products, tailored to the requirements of e.g. allergic subjects, ambitious cooks, traditionalists or globalists, etc.

## MARKETING VS. R&D

Innovation in this respect might seem to be a marketing rather than a research challenge. And marketing makes use of this kind of diversification to deliver respective novelties. But for a non-transient success breeder, grower, processer, packer, wholesaler and retailer have to make sure that product attributes consistently

**Fresh and organic juices at the airport of Munich, Germany** (Photo S. Nicola).

meet the heterogeneous needs of the profession and consumers or consumer segments. The challenge for quality related horticultural research is to uncover the mechanisms how this can be done.

The feedback from the attendants of the workshop encouraged us to carry this topic forward. The next workshop on the topic is taking place at the II International Conference on Quality Management of Fresh-Cut Produce, Convenience Food for a Tasteful Life, Torino, Italy, 17-21 July 2011. The workshop will focus on 'What do we mean by quality' in convenience food and we hope to receive a high attendance also at the second workshop.

Bernhard Brueckner and Silvana Nicola


### CONTACT

Dr. Bernhard Brueckner, Senior Scientist, Quality Department, Sensory and Cosumer Investigations, Leibniz-Institute for Vegetable and Ornamental Crops, Großbeeren, Germany, email: brueckner@igzev.de

Dr. Silvana Nicola, Associate Professor, Vegetable Crops and Medicinal and Aromatic Plants Program, Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Universitá di Torino, Italy, email: silvana.nicola@unito.it


## 10TH INT'L SYMPOSIUM ON VACCINIUM AND OTHER SUPERFRUITS

**June 18-22, 2012, at the Floriade World Horticultural Expo, Venlo, The Netherlands**

During the last decade many fruits have received increased global attention due to the recognition that they may be a significant source of healthy bio-active compounds such as polyphenols and other healthy phytochemicals that contribute to the health maintenance of cells and organs as well as to optimal organ functions. These fruits include blueberry, blackberry, raspberry and strawberry as well as açai, noni, mangosteen, goji, and pomegranate. Claims concerning improved vitality, cognition and healthy ageing, enhanced physical performance and reduced chronic disease risks are hitting the popular press and as a result health has become a major driver of consumer behavior.

Apart from the health aspect these fruits have taste, flavor and color characteristics that make them very attractive for use in food and drinks. As a result, marketers have started to promote these fruits under the name "super fruits." Their dried versions, pastes, concentrates, powders and colorants in food and beverage have developed explosively. Advances in horticultural science including harvesting and processing technology and related logistics and supply chains have made global distribution a reality. The time is ripe to get to know all about the state of art in this booming sector.

A forthcoming opportunity is the 10th International Symposium on Vaccinium and Other Superfruits that will take place from June 18-22, 2012 in Venlo, Province of Limburg, the Netherlands, during the spectacular Floriade World Horticultural Expo. The symposium is a collaboration of the ISHS *Vaccinium* Species Working Group of the Vine and Berry Fruits Section, the ISHS Commission Fruits and Vegetables and Health, the ISHS Commission Plant Genetic Resources, and the Scientific and Technical Commission of the International Federation of Fruit Juice Producers (IFU). The symposium will cover the entire chain from growth, harvest, processing, product development and finally consumption and will run along 3 main lines: Horticultural Sciences, Health Sciences, and Business, Technology & Marketing.

The Floriade World Horticultural Expo will include 3 days of scientific meetings and trade exhibition, as well as 2 days of pre- and post symposium tours to allow participants and accompanying persons to experience local harvesting and production activities and the cultural beauty. The symposium organization is a joint activity between Maastricht University and Wageningen University. We look forward to seeing you in 2012 in Venlo!

### Contact

Dr. Fred Brouns, School of Nutrition, Toxicology and Metabolism, Maastricht University, The Netherlands, email: fred.brouns@maastrichtuniversity.nl
Dr. Olaf van Kooten, Horticultural Supply Chains group, Wageningen University, The Netherlands, email: olaf.vankooten@wur.nl
www.vaccinium2012.com

## From the Secretariat

# New ISHS Members

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

### NEW INDIVIDUAL MEMBERS:

**Albania:** Ramiz Jahbala; **Argentina:** Antonio Alvarez, Dante Rafael Aramayo, Pablo Chiementon; **Australia:** Andrew Cameron, Mr. James Cathcart, Ms. Claire Collie, Ms. Bethany Collins, Mr. David Gale, Mr. Gerhard Grasser, Mr. Vick Grozotis, Ms. Catherine Hird, Dr. Richard Hodgson, Mr. Kynan Jackson, Mr. Hong Tao Liu, Ms. My Nguyen, Dr. Belinda Rawnsley, Mr. Geoff Richards, Mr. James Royal, Mr. Tim Sansom, Ms. Prue Shepherd, Mr. Marcel Veens, Mr. Matthew Weinert; **Belgium:** Etienne Langouche, Yves Laurijssens, Dr. Muriel Quinet; **Brazil:** Dr. David Buss, Rousseau da Silva Campos, Magda Laiara B. de Lima, Riselane de Lucena Alcantara Bruno, Silvanda de Melo Silva, Glauber Henrique de Sousa Nunes, Mariana Ferraz Monteiro, Mr. André Figueira, Enio Giuliano Girão, Mary de Fátima Guedes dos Santos, Maria do Socorro Moura Rufino, Eliseu Marlônio Pereira de Lucena, Joaci Pereira de Sousa, Maria Pinheiro Fernandes Corrêa, Denise Soares Josino; **Canada:** Mr. Roger Bailey, Tom Bruulsema, Ms. Liette Lambert, William MacDonald, Mr. Andrew Thornley, Ms. Maanaesweri Venkatsubbu, Mr. David Wattie; **Chile:** Jorge Arenas Charlin, Mr. Felipe Astudillo, Nicolás Franck Berger, Mr. Christian Magdahl; **China:** Shu Jia Zhai; **Chinese Taipei:** Dr. Dennis Wang; **Colombia:** Dr. Marco Quijano-Rico; **Croatia:** Mr. Ilija Obradovic; **Denmark:** Mr. Jorgen Logstrup, Dr. Sine Topp; **Finland:** Sanna Kauppinen; **France:** Mr. Jean-François Colonat, Dr. Didier Mbeguie-a-Mbeguie; **Germany:** Ms. Eva-Maria Braun, Prof. Dr. Claus Bull, Ms. Centa Kirsch, Mr. Axel Oltrogge, Dr. Sietske Maart Stuiver-Hoekstra; **Greece:** John Baras, Ms. Stelina Tsiantou; **Guatemala:** Prof. Armando Caceres; **Hungary:** Dr. Zsuzsanna György, Szilvia Németh, Márk Steiner; **India:** Daksha Bhatt, Dr. Sukhen Chandra Das, Mr. Nikhil Gupta, Mr. Raghav Jadli, Mr. Sharad Nimbalkar; **Iran:** Assist. Prof. Abdollah Ghasemi Pirbalouti, Dr. Sasan Rastgoo, Dr. Shahram Sharafzadeh; **Ireland:** Mr. Thomas Cunningham; **Italy:** Emanuela Borio, Mr. Marco Facollo, Dr. Daniela Farinelli, Pietro Nicolo Simonini; **Japan:** Dr.

Ryuta Ibuki, Satowa Nabeshima, Assist. Prof. Eiko Oide, Mitsuo Ooyama, Prof. Dr. Hiroshi Shimizu; **Kenya:** Dr. Katja Kehlenbeck; **Korea (Republic of):** Mr. Hyungsu Mun; **Kosovo:** Maxhun Shehaj; **Latvia:** Ms. Dzintra Dekena; **Malaysia:** Dr. Rosenani Abu Bakar, Assist. Prof. Aziz Ahmad, Ms. Wong Weng Yin, Mr. Md Roslan Zulkifly; **Malta:** Mr. Ivan Cassar; **Mexico:** Maria Andrade Rodríguez, Maria de Lourdes Arévalo Galarza, Mr. Alberto Bethke, Nidelvia del Jesús Bolívar Fernández, Raul Bribiesca, Prof. Humberto Castillo, Americo Florez Medina, Araceli Minerva Vera Gusmán, Maria de Jesús Juárez Hernández, Alejandro Ledesma Miramontes, Victor Lopez Martinez, Juan Martinez Solis, Rafael Mora Aguilar, Esaú del Carmen Moreno Pérez, Dr. Luis Mario Tapia, Georgina Vargas Simón, Angel Villegas Monter; **Netherlands:** Prof. Dr. Fred Brouns, Moritz Ceulemans, Mr. Peter Ibes, Ms. Gloria Otieno, Richard van der Sande, Mr. Tony van Leersum, Mr. Maarten Weerenbeck; **New Caledonia:** Dr. Nadia Robert; **New Zealand:** Mr. Michael Sue; **Nigeria:** Dr. Blessing Agoreyo, Mr. John Alewi, Dr. Abdu Ahmed Manga, Dr. Iheanyi Ogoke, Dr. Alexandra zum Felde; **Pakistan:** Mr. Junaid Shah; **Panama:** Mr. Walter Cantore; **Peru:** Mr. Hermann Baumann, Liliana Gabriela Benavides Manrique, Alberto Marcial Julca Otiniano, Guillermo Jose Parodi U., Prof. Federico Ramirez; **Poland:** Mateusz Skwarka; **Portugal:** Ms. Sílvia Bulhes, Prof. Susana Caldas-Fonseca, Mr. Andrew Henley-Welch, Dr. Pedro Toste Mendes; **Romania:** Mr. Iosif-Karoly Kiss, Mr. Traian Gabriel Matei, Prof. Dr. Florin Sala, Mr. Andrei-Niculae Tanase; **Russian Federation:** Prof. Dr. Evgeny Koshkin; **Serbia:** Prof. Dr. Momcilo Radulovic; **South Africa:** Dr. Kobie de Ronde, Mr. Herman Erasmus, Dr. Henry Hartley, Mr. Peter Januarie; **Spain:** Clara Argudo Osado, Dr. Julian Bartual, David Bertran, Esteban Candel Ayala; **Sweden:** Ke Truedsson; **Switzerland:** Paul Sphikas; **Tanzania:** Mr. Raam Prakash Narayanan Ramesh; **Thailand:** Dr. Piyasak Chaumpluk; **Turkey:** Prof. Dr. Zeki Kara, Mr. Tahsin Ünal; **United Kingdom:** Mr. Idris El Tawil, Mr. Oliver Hombersley, Ms. Julia Lock, Mr. Lance Mansell, Dr. Martin McPherson, Mr. Stead Nicolle, Dr. Jamie Robinson, Dr. Russell Sharp, Mr. Shaun Sparke, Dr. Timothy Wilkinson; **United States of America:** Zoraia de Jesus Barros, Dr. Margaret Barth, Dr. Bruno Borsari, Ms. Debra Clarke, Mr. Trevor Clarke, Gary Clynick, Gayle Crisosto, Mr. Dale Davis, Amy Detweiler, Todd Erickson, Mr. Bijan Esfahani, Robert Fassel, Dr. Jalal Ghaemghami, Mr. Ryan Greene, Dr. Elizabeth Guertal, Alan Haigh, Mr. Jeff Hamel, Ben Holmes, Dr. Bill Hurst, Dr. Hannah James, Joyce Jong, Dr. Yong-Ki Kim, Zak Laffite, Dr. Blanca Leon, Andrew Lord, Amanda Martin, Abby Massey, Mr. Thomas McBride, Juan Carlos Melgar, Mr. Shawn Olson, Mr. Chris Parks, Clifford Perez, Dr. Emil Radkov, Mr. Adam Roddy, Maria Rubino, Dr. Manuel Segovia, Mr. Majid Tavallaei, Prof. Jeanmarie Verchot, Dr. Matthias Vitten, Carol Wilkinson; **Venezuela:** Miguel Angel Maffei Valero, Norkis Meza, Maria Angélica Ormeño Díaz, Ibis J. Quintero Chinnos, Rosario Emperatriz Valera, Judith Zambrano de Valera

## PASSED AWAY

Prof. Dr. Josef Sieber (1920-2011) passed away on 26 January 2011. He has been an active member of the ISHS Section Ornamental Plants from 1997-2009

# Calendar of ISHS Events

As a result of the March 11, 2011 natural disaster in Japan the Organizing Committee of the II Asian Horticultural Congress (AHC 2012), scheduled for March 27-30, 2012, Tsukuba (Japan), decided to cancel the event. We wish our Japanese colleagues all strength in rebuilding their country.

**For updates and more logon 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 2011

- June 13-17, 2011, Quebec City (Canada): **International Symposium on Responsible Peatland Management and Growing Media Production.** Info: Dr. Line Rochefort, Department of Plant Sciences, Université Laval, Pavillon P. Comtois, 2425, rue de l'Agriculture, Québec, QC G1V 0A6, Canada. Phone: (1)4186562131ext2583, Fax: (1)4186567856, E-mail: line.rochefort@fsaa.ulaval.ca or Jean Caron, Department of Soil Sciences, Université Laval, Pavillon P. Comtois, 2425 rue de l'Agriculture, Quebec, QC G1V 0A6, Canada. Phone: (1)4186562131ext2881, Fax: (1)4186567856, E-mail: jean.caron@fsaa.ulaval.ca Web: http://www.peatlands2011.ulaval.ca/
- June 19-23, 2011, Saint-Jean-sur-Richelieu (Canada): **IX International Symposium on Modelling in Fruit Research and Orchard Management.** Info: Dr. Gaetan Bourgeois, Agriculture and Agri-Food Canada, Horticultural R&D Centre, 430 Blvd. Gouin, Saint-Jean-sur-Richelieu,QC J3B 3E6, Canada. Phone: (1)4505152017, Fax: (1)4503467740 E-mail symposium: ISMFR2011@agr.gc.ca Web: http://www.cshs.ca/modelling/
- June 20-24, 2011, Yerevan (Armenia): **XV International Symposium on Apricot Breeding and Culture.** Info: Dr. Alvina Avagyan, Armenian State Agrarian University, 74, Teryan Street, Yerevan, Armenia. Phone: (374)93415037, Fax: (374)10202834x121, E-mail: alvinaav@mail.ru or Dr. Aleksandr Kalantaryan, 37 Mamikonyants street. ap.49, 00010 Yerevan, Armenia. Phone: (374) 10237805, E-mail: alikjan@gmail.com E-mail symposium: info@apricot2011.com Web: http://www.apricot2011.com/
- NEW June 21-23, 2011, Lucknow (India): **Global Conference on Augmenting Production and Utilization of Mango: Biotic and Abiotic Stresses.** Info: Dr. Hutchappa Ravishankar, Central Inst. for Subtropical Hortic., Rehmankhera, PO Kakori, Lucknow, Uttar Pradesh, 227 107, India. Phone: (91)5222841022, Fax: (91)5222841025, E-mail: drhravishankar@gmail.com E-mail symposium: mangosymposium@gmail.com Web: http://www.intmangosymp.org/
- NEW June 22-25, 2011, San Michele all'Adige and Bologna (Italy): **Workshop on Floral Biology and S-Incompatibility in Fruit Species.** Info: Prof. Dr. Silviero Sansavini, Dipt. di Colture Arboree, Univ. degli Studi di Bologna, Viale G. Fanin 46, 40127 Bologna, Italy. Phone: (39)0512096422, Fax: (39)0512096401, E-mail: silviero.sansavini@unibo.it
- June 22-26, 2011, Zlatibor (Serbia): **X International Rubus and Ribes Symposium.** Info: Prof. Dr. Mihailo Nikolic, Faculty of Agriculture, University of Belgrado, 6 Nemanjina, 11080 Belgrade, Serbia. Phone: (381)63 801 99 23, Fax: (381)11 21 93 659 or Dr. Brankica Tanovic, Pesticide & Environment Research Inst., 31b Banatska, 11080 Zemun-Belgrade, Serbia. Phone: (381) 11 31 61

773, Fax: (381) 11 30 76 133 E-mail symposium: x.rubusribes@agrif.bg.ac.rs Web: http://www.x-rubusribes.agrif.bg.ac.rs/

- June 27 - July 1, 2011, Kuala Lumpur (Malaysia): **II International Symposium on Underutilized Plants: Crops for the Future - Beyond Food Security.** Info: Festo John Massawe, Nottingham University Malaysia Campus, School of Biosciences, Jalan Broga, 43500 Semenyih, Malaysia. Phone: (60)389248218, Fax: (60)389248018, E-mail: festo.massawe@nottingham.edu.my E-mail symposium: cropsforthefuturesymposium@nottingham.edu.my Web: http://www.cffsymposium2011.org/
- June 29 - July 3, 2011, Nanjing (China): **III International Conference on Landscape and Urban Horticulture.** Info: Prof. Dr. Wuzhong Zhou, Institute of Tourism & Landscape Archit., Southeast University, No. 2 Si Pai Lou, Nanjing, Jiangsu, 210096, China. Phone: (86)2583692608, Fax: (86)2583690357, E-mail: wzzhou@seu.edu.cn E-mail symposium: sec.luh2011@gmail.com Web: http://www.luh2011.org/
- July 4-7, 2011, Wisley (United Kingdom): **I International Trials Conference: Assessment of Ornamental Plants.** Info: Ms. Prunella Scarlett, Royal Horticultural Society, Wisley, Woking, Surrey GU23 6QB, United Kingdom. Phone: (44)148322423, Fax: (44)1483211750, E-mail symposium: ornamentals2011@rhs.org.uk Web: http://www.rhs.org.uk/ornamentals2011
- July 6-9, 2011, Saas-Fee (Switzerland): **I International Symposium on Medicinal, Aromatic and Nutraceutical Plants from Mountainous Areas.** Info: Dr. Christoph Carlen, Agroscope Changins-Wädenswil ACW, Centre de Recherche Conthey, Route des Vergers 18, 1964 Conthey, Switzerland. Phone: (41) 27 345 35 11, Fax: (41) 27 346 30 17, E-mail: christoph.carlen@acw.admin.ch Web: http://www.agroscope.admin.ch/mapmountain/
- July 17-21, 2011, Torino (Italy): **II International Conference on Quality Management of Fresh Cut Produce: Convenience Food for a Tasteful Life.** Info: Prof. Dr. Silvana Nicola, Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Via Leonardo Da Vinci 44, 10095 Grugliasco (TO), Italy. Phone: (39)0116708773, Fax: (39)0112368773, E-mail: silvana.nicola@unito.it E-mail symposium: email the freshcut2011 secretariat Web: http://www.freshcut2011.org/
- NEW August 17-19, 2011, Flores, Petén (Guatemala): **International Symposium on Medicinal and Aromatic Plants; History of Mayan Ethnopharmacology.** Info: Dr. Jalal Ghaemghami, Director of SHMEN Inc., PO Box 320172, West Roxbury, MA 02132, United States of America. Phone: (1)6176782157, E-mail: jalal@shmen.org E-mail symposium: ishs-tikal@shmen.org Web: http://www.imaps2011-peten.org/
- NEW September 3-7, 2011, Xinzheng, Henan (China): **II International Jujube Symposium.** Info: Prof. Dr. Mengjun Liu, Research Center of Chinese Jujube, Agricultural Univesity of Hebei, Baoding, Hebei, 71001, China. Phone: (86)312754342, Fax: (86)3127521251, E-mail: lmj1234567@yahoo.com.cn or Dr. Jubin Shi, Haoxiangni Jujube Co. Ltd., Xinzheng, Henan, 451150, China. Phone: (86)37162489919, Fax: (86)37162489198, E-mail: ijs2008@yahoo.com.cn Web: http://www.ziziphus.net/2011/
- September 5-7, 2011, Pitesti (Romania): **II Balkan Symposium on Fruit Growing.** Info: Dr. Mihail Coman, Fruit Research Institute, Str. Popa Sapca, Nr. 14, Cod. 110150, Jud. Arges, Pitesti-Maracineni 0300, Romania. Phone: (40)248278292, Fax: (40)248278477, E-mail: mihailcoman1@gmail.com E-mail symposium: office@icdp-pitesti.ro Web: http://bsfg2011.icdp.ro/
- September 10-12, 2011, Damghan (Iran): **I International Symposium on Mycotoxins in Nuts and Dried Fruits.** Info: Dr. Hossein Abbaspour, Islamic Azad University, Damghan Branch, Damghan, Iran. Phone: (98)2325235214, Fax: (98)2325235214, E-mail: abbaspour75@yahoo.com E-mail symposium: afshari@mycotoxinsymp.com Web: http://www.mycotoxinsymp.com/
- September 11-15, 2011, Warsaw (Poland): **XIII Eucarpia Symposium on Fruit Breeding and Genetics.** Info: Dr. Emilian Pitera, Warsaw University of Life Sciences, SGGW - Department of Pomology, ul. Nowoursynowska 166, 02-787 Warszawa, Poland. Phone: (48)225932087, Fax: (48)225932111, E-mail: emilian_pitera@sggw.pl Web: http://www.eucarpia2011.woiak.sggw.pl/
- September 11-15, 2011, Nelspruit (South Africa): **II ISHS Genetically Modified Organisms in Horticulture Symposium: Paving the Way for a Sustainable Future.** Info: Ms. Adri Veale, University of Pretoria, Faculty of Natural and Agric. Science, Department of Genetics, 0002 Pretoria, South Africa. Phone: (27)12-4203939, Fax: (27)12-4203960, E-mail: adri.veale@up.ac.za E-mail symposium: ishsgmo2011@gmail.com Web: http://www.gmo2011.co.za/
- **Symposium POSTPONED - New date soon to be announced**
  NEW September 17-19, 2011, Tunis (Tunisia): **I International Symposium on Cassava Market and Economy.** Info: Dr. Antonio Felice, Via Fiordiligi 6, 37135 Verona, Italy. Phone: (39)0458352317, Fax: (39)0458307646, E-mail: editor@greenmed.eu or Prof. Dario Salvatore Caccamisi, Monticello 10B, 41052 Guiglia (Modena), Italy. Phone: (39)059-792778, Fax: (39)059-792778, E-mail: dario.caccamisi.agronomo@hotmail.it
- September 18-22, 2011, Ghent (Belgium): **VII International Symposium on In Vitro Culture and Horticultural Breeding: IVCHB.** Info: Danny Geelen, Coupure Links 653, 9000 Gent, Belgium. Phone: (32)9264 60 76 E-mail symposium: IVCHB2011@UGent.be Web: http://www.ivchb2011.ugent.be/
- October 9-12, 2011, Tirana (Albania): **V Balkan Symposium on Vegetables and Potatoes.** Info: Prof. Astrit Balliu, Agricultural University of Tirana, Faculty of Agriculture, Horticultural Department, Tirana, Albania. Phone: (355)686022105, E-mail: aballiu@ubt.edu.al E-mail symposium: ssecretary@ubt.edu.al Web: http://5bsvp.ubt.edu.al/
- **Symposium POSTPONED - New date soon to be announced**
  NEW October 10-12, 2011, Zürich (Switzerland): **I International Workshop on Bacterial Diseases of Stone Fruits and Nuts.** Info: Dr. Brion Duffy, Agroscope Faw, Schloss, Postfach 185, 8820 Waedenswil, Switzerland. Phone: (41)447836111, Fax: (41)447836305, E-mail: duffy@acw.admin.ch
- October 10-14, 2011, Salvador (Bahia) (Brazil): **International ISHS-ProMusa Symposium - ProMusa 2011.** Info: Dr. Edson Perito Amorim, Embrapa Cassava and Tropical Fruits, Embrapa Avenue, Cruz das Almas Bahia 44380000, Brazil. E-mail: edson@cnpmf.embrapa.br or Dr. Aristoteles Pires de Matos, EMBRAPA - CNPMF, Rua Embrapa s/n, Caixa Postal 007, Cruz das Almas, Bahia 44380-000, Brazil. Phone: (55)7536218000, Fax: (55)7536211118, E-mail: apmatos@cnpmf.embrapa.br E-mail symposium: symposium@promusa.org Web: http://www.gt5.com.br/promusa/
- October 16-19, 2011, University Park, PA (United States of America): **International Symposium on High Tunnel Horticultural Crop Protection.** Info: Dr. Michael Orzolek, 203 Tyson Bldg, The Pennsylvania State University, University Park, PA 16802, United States of America. Phone: (1)814 863-2251, E-mail: mdo1@psu.edu Web: http://horticulture.psu.edu/cms/ishs2011/
- NEW October 16-20, 2011, Nebraska City, NE (United States of America): **V International Symposium on Acclimatization and Establishment of Micropropagated Plants.** Info: Prof. Paul E. Read, Univ. Nebraska, Inst. of Agr., & Nat. Resources, Dept. Hort., 377 Plant Sci., East Campus, Lincoln, NE 68583-0724, United States of America. Phone: (1)402-472-2854, Fax: (1)402-472-8650, E-mail: pread@unl.edu or Prof. Dr. John E. Preece, Supervisory Research Leader USDA-ARS, 1 Shields Avenue, University of California, Davis, CA 95616-8607, United States of America. Phone: (1)530-752-

7009, Fax: (1)530-752-5974, E-mail: john.preece@ars.usda.gov Web: http://agronomy.unl.edu/isaemp-2011

- October 17-21, 2011, Barcelona (Spain): **International Symposium on Growing Media, Composting and Substrate Analysis.** Info: Prof. Dr. Xavier Martínez Farré, Escola Superior Agricultura (ESAB-EUETAB), Campus Baix Llobregat, Av. Canal Olímpic s/n, 08860 Castelldefels, Spain. Phone: (34)935521094, Fax: (34)935521001, E-mail: xavier.martinez-farre@upc.edu E-mail symposium: growingmedia.composting2011@upc.edu Web: http://www.upc.edu/growingmediacomposting2011

- NEW November 2-4, 2011, Bogotá (Colombia): **II International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions.** Info: Dr. Maria Hernandez, ICTA Institute, Ciudad Universitaria, Universidad Nacional de Colombia, Ed 500 C - Bogotá, Colombia. Phone: (57)12536607, Fax: (57)12862418, E-mail: mshernandez@unal.edu.co

- November 3-4, 2011, Launceston, Tasmania (Australia): **International Symposium on Pyrethrum, The Natural Insecticide: Scientific and Industrial Developments in the Renewal of a Traditional Industry.** Info: Mr. Brian Chung, Botanical Resources Australia, PO Box 852, Sandy Bay, Hobart, TAS 7006, Australia. Phone: (61)362244511, Fax: (61)362244473, E-mail: bchung@pyrethrum.com.au E-mail symposium: py2011@pyrethrum.com.au Web: http://www.botanicalra.com.au/Site/pdfs/py_conf_info.pdf

- NEW November 13-14, 2011, Algiers (Algeria): **International Conference on Date Palm.** Info: Prof. Dr. Nadia Bouguedoura, Univ. of Science H. Boumediene, Biologie et Physiologie, BP 31 El Alia Babzzmar, Algiers 16111, Algeria. Phone: (213)771697122, Fax: (213)4247217, E-mail: nadiaboug@gmail.com Web: http://lrza.info

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

- November 22-25, 2011, Buenos Aires (Argentina): **VII International Symposium on New Floricultural Crops.** Info: Dr. Gabriela Facciuto, INTA, Los Reseros y Las Cabañas s/n, Castelar, 1712, Argentina. E-mail: gfacciuto@cnia.inta.gov.ar Web: http://www.inta.gov.ar/floricultura/newornamentals2011/index.asp

- November 24-27, 2011, Chiang Mai (Thailand): **III International Symposium on Papaya - Royal Flora 2011.** Info: Dr. Jirakorn Kosaisawe, Director General, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: jirakorn_k@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royal-flora2011.com/index_eng.html

- NEW November 27-30, 2011, Tel Aviv (Israel): **Frontiers of Citrus2011.** Info: Dr. Yair Erner, Department of Fruit Tree Sciences, ARO, The Volcani Center, PO Box 6, Bet-Dagan 50-250, Israel. Phone: (972)3-9683414, Fax: (972)3-9669583, E-mail: yerner@volcani.agri.gov.il or Prof. Dr. Raphael Goren, James de Rothschild Professor of Horticulture, The Hebrew University of Jerusalem, PO Box 12, Rehovot 76-100, Israel. Phone: (972)89489348, Fax: (972)89489574, E-mail: rgoren@agri.huji.ac.i Web: www.frontierscitrus2011.com

- November 29 - December 2, 2011, Chiang Mai (Thailand): **International Symposium on Tropical and Subtropical Fruits - Royal Flora 2011.** Info: Peyanoot Ms. Naka, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com or Dr. Somchai Charnnarongkul, Department of Agriculture, Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: tosomchai@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html

- December 3-6, 2011, Bangkok (Thailand): **International Conference on Quality Management in Supply Chains of Ornamentals (QMSCO 2011).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th E-mail symposium: qmsco@kmutt.ac.th Web: http://www.kmutt.ac.th/QMSCO2011/

- NEW December 3-6, 2011, Bangkok (Thailand): **Asia Pacific Symposium on Postharvest Quality Management of Root and Tuber Crops.** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th Web: http://www.kmutt.ac.th/APS2011/

- NEW December 3-6, 2011, Bangkok (Thailand): **I International Symposium on Postharvest Pest and Disease Management in Exporting Horticultural Crops.** Info: Pongphen Jitareerat, King Mongkut's Univ. of Technology Thonburi, Div. Postharv.Techn. School of Biores.& Techn., 83 Moo 8, Tientalay rd., 10150 BKK -Bangkhuntien, Thakham, Thailand. E-mail: pongphen.jit@kmutt.ac.th E-mail symposium: ppmd2011@kmutt.ac.th Web: http://www.kmutt.ac.th/ppdm2011/

- December 3-6, 2011, Bangkok (Thailand): **Southeast Asia Symposium on Quality Management in Postharvest Systems (SEAsia2011).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th Web: http://www.kmutt.ac.th/SEAsia2011

- December 9-12, 2011, Madurai (India): **I International Symposium on Cashew Nut.** Info: Dr. Ravindran Chandran, Assistant Professor, KVK, AC & RI, Tamil Nadu Agricultural University, Madurai, 625104 (Tamil Nadu), India. Phone: (91)452-2422955, Fax: (91)452-2422785, E-mail: ravi_hort@yahoo.com Web: http://www.cashewnut2011.co.cc/

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

## YEAR 2012

- January 9-13, 2012, Chiang Mai (Thailand): **International Symposium on Orchids and Ornamental Plants - Royal Flora 2011.** Info: Peyanoot Ms. Naka, Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand. Phone: (66)819076821, Fax: (66)25614667, E-mail: peyanoot@hotmail.com or Dr. Somchai Charnnarongkul, Department of Agriculture, Phahonyothin Rd., Chatuchak, Bangkok 10900, Thailand. Phone: (66)25799636, Fax: (66)29405412, E-mail: tosom-

chai@yahoo.com E-mail symposium: royalflorasymposium2011@yahoo.com Web: http://www.royalflora2011.com/index_eng.html

- NEW January 15-20, 2012, Nelspruit, Kruger National Park (South Africa): **II All Africa Horticultural Congress.** Info: Ms. Karin Hannweg, ARC-ITSC, Private Bag X11208, Nelspruit Mpumalanga 1200, South Africa. E-mail: karin@arc.agric.za Web: http://www.aahc.co.za/
- February 18-22, 2012, Beijing (China): **VII International Strawberry Symposium.** Info: Dr. Zhang Yun-tao, Forestry & Pomology Institute of Beijing, Rui Wang Fen, Xiang-Shan, Hai Dian District, Beijing 100093, China. Phone: (86)1082592157, Fax: (86)1062598744, E-mail: ytaozhang@gmail.com E-mail symposium: strawberry2012@163.com Web: http://www.iss2012bjchina.org.cn/
- NEW March 19-22, 2012, Temuco (Chile): **VIII International Congress on Hazelnut.** Info: Dr. Pablo Grau Beretta, INIA, Avda. Vicente Mendez 515, Chillan, Chile. Phone: (56)42 209707, Fax: (56)42 209720, E-mail: pgrau@inia.cl or Miguel Ellena Dellinguer, INIA, Instituto De Investigaciones Agropeciarias, Km 10, Camino Cajon Vilcun, Temuco, Chile. Phone: (56)45 215 706, Fax: (56)45 216 112, E-mail: fellena@inia.cl
- NEW March 22-24, 2012, Djerba (Tunisia): **IV International Symposium on Medicinal and Aromatic Plants SIPAM2012**. Info: Dr. Houcine Khatteli, Institut des Régions Arides, Route de Djouf, Km 22,5, 4119 Médenine, Tunisia. Phone: (216)75633121, Fax: (216)75633006, E-mail: h.khatteli@ira.rnrt.tn or Dr. Mohamed Neffati, Institut des Regions Arides (IRA), Route de Djorf Km 22,5, 4119 Medenine, Tunisia. Phone: (216)75633839, Fax: (216)75633006, E-mail: neffati.mohamed@ira.rnrt.tn E-mail symposium: sipam@ira.rnrt.tn Web: http://www.sipam.ira.rnrt.tn/
- March 26-30, 2012, Nelson (New Zealand): **II International Symposium on Biotechnology of Fruit Species.** Info: Roger Hellens, Plant & Food Research, 120 Mt Albert Road, Auckland, New Zealand. Phone: (64)98154200, E-mail: roger.hellens@plantandfood.co.nz or Dr. Susan Elizabeth Gardiner, Plant & Food Research, Tennant Drive Private Bag 11030, Palmerston North , New Zealand. E-mail: sue.gardiner@plantandfood.co.nz E-mail symposium: yvonne.mcdiarmid@plantandfood.co.nz Web: http://www.plantandfood.co.nz/conferences/biotechfruit-2012/
- NEW As a result of the March 11, 2011 natural disaster in Japan the AHC2012 organizing committee decided to CANCEL the AHC2012 March 27-30, 2012, Tsukuba (Japan): **II Asian Horticultural Congress AHC 2012.** Info: Prof. Dr. Yoshinori Kanayama, Graduate Sch. of Agric., Tohoku Univ., 1-1 Tsutsumidori, Amamiyamachi, Aoba-ku, Sendai 981-8555, Japan. Phone: (81)227178642, Fax: (81)227178878, E-mail: kanayama@bios.tohoku.ac.jp E-mail symposium: info@ahc2012.com Web: http://www.ahc2012.com
- NEW March 28 - April 1, 2012, Antalya (Turkey): **XI International Symposium on Flower Bulbs and Herbaceous Perennials.** Info: Prof. Dr. Ibrahim Baktir, Akdeniz University, Faculty of Agriculture, Department of Horticulture, Campus, 07058 Antalya, Turkey. Phone: (90)2423102468, Fax: (90)2422274564, E-mail: ibrahim.baktir@gmail.com E-mail symposium: flowerbulbs2012@gmail.com Web: http://flowerbulbs2012.org/
- NEW April 10-13, 2012, Viterbo (Italy): **VIII International Symposium on Artichoke, Cardoon and their Wild Relatives.** Info: Prof. Mario-Augusto Pagnotta, Dipt. di AgroBiologia e AgroChimica, Universita' della Tuscia, Via S.C. de Lellis, 01100 Viterbo, Italy. Phone: (39)0761357242, Fax: (39)0761357423, E-mail: pagnotta@unitus.it or Prof. Dr. Francesco Saccardo, Dip.di Produzione Vegetale, University of Tuscia, Via S. Camillo de Lellis, 01100 Viterbo VT, Italy. Phone: (39)0761357554, Fax: (39)0761357558, E-mail: saccardo@unitus.it Web: http://www.symposium2012.cynares.com/
- April 18-22, 2012, Antalya (Turkey): **IV International Symposium on Improving the Performance of Supply Chains in the Transitional Economies.** Info: Prof. Dr. Burhan Ozkan, Department of Agricultural Economics, Faculty of Agriculture, University of Akdeniz, 07070 Antalya, Turkey. Phone: (90)2423102475, Fax: (90)2422274564, E-mail: bozkan@akdeniz.edu.tr or Dr. Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au Web: http://www.supply-chains2012.org/
- April 23-25, 2012, Petrolina, Pernambuco (Brazil): **III International Symposium on Guava and other Myrtaceae.** Info: Dr. Natoniel Franklin de Melo, EMBRAPA-CPATSA, Cx.Postal 23, Lab. de Biotecnologia, CEP 56302-970 Petrolina -PE, Brazil. or Dr. Carlos Antonio Fernandes Santos, EMBRAPA CPATSA, Km 152, Zona Rural, Caixa Postal 23, 56302-970 Petrolina, Brazil. Phone: (55)08738621711, Fax: (55)08738621744, E-mail: casantos@cpatsa.embrapa.br Web: http://www.cpatsa.embrapa.br/3rdsygom/en/
- NEW April 23-26, 2012, Santa Cruz (Chile): **XI International Protea Research Symposium.** Info: Mr. Eduardo Olate, P. Universidad Catolica De Chile, Avenida Vicuna Mackenna 4860, Fac.de Agronomia, Santiago RM, Chile. Phone: (56)23544112, Fax: (56)25520780, E-mail: eolate@uc.cl or Mrs. Flavia Schiappacasse, Universidad de Talca, Facultad de Ciencias Agrarias, Casilla 747, Talca, Chile. Phone: (56)71200214, Fax: (56)71200212, E-mail: fschiap@utalca.cl
- May 1-5, 2012, Antalya (Turkey): **International Symposium on Biotechnology and other Omics in Vegetable Science.** Info: Prof. Dr. Ahmet Naci Onus, Department of Horticulture, Faculty of Agriculture, Akdeniz University, 07059 Antalya, Turkey. Phone: (90) 242-3102441, Fax: (90) 242- 2274564, E-mail: onus@akdeniz.edu.tr
- NEW May 15-17, 2012, Tel Aviv (Israel): **The International CIPA Conference 2012: Plasticulture for a Green Planet.** Info: Mr. Itzhak Esquira, Ministry of Agriculture, 34 Burla Street, Apt. 2, 69364 Tel Aviv, Israel. E-mail: esquirai@gmail.com E-mail symposium: Pzilberman@kenes.com Web: http://www2.kenes.com/agritech2012/conference/Pages/Conference.aspx
- May 19-25, 2012, Chanthaburi (Thailand): **VII International Symposium on Mineral Nutrition of Fruit Crops.** Info: Dr. Sumitra Poovarodom, King Mongkut's Inst. of Tech., Landkrabang, Faculty of Agric. Technology, 10520 Bangkok, Thailand. Phone: (66)262341001, Fax: (66)232641001, E-mail: kpsumitr@kmitl.ac.th
- May 20-26, 2012, Davis, CA (United States of America): **X International Symposium on Plum and Prune Genetics, Breeding and Technology.** Info: Prof. Ted M. DeJong, University of California, Department of Plant Sciences, Wickson Hall, One Shields Ave, Davis, CA 95616-8683, United States of America. Phone: (1)530-752-1843, Fax: (1)530-752-8502, E-mail: tmdejong@ucdavis.edu or Carolyn DeBuse, University of California Cooperative Extension, 501 Texas Street, Fairfield, CA 94533, United States of America. Phone: (1)707-784-1320, E-mail: cjdebuse@ucdavis.edu
- NEW May 21-24, 2012, Fukuoka (Japan): **VI International Symposium on Edible Alliaceae.** Info: Prof. Dr. Masayoshi Shigyo, Faculty of Agriculture, Yamaguchi University, Yoshida 1677-1, Yamaguchi 753-8515, Japan. Phone: (81)839335842, Fax: (81)839335842, E-mail: shigyo@yamaguchi-u.ac.jp E-mail symposium: isea2011@convention.co.jp Web: http://www2.convention.co.jp/isea2011/
- May 22-25, 2012, Shanghai (China): **International Symposium on Soilless Cultivation.** Info: Mr. Weimin Zhu, Hort.Inst. of Shanghai Academy of Agr. Sci., Beidi Road 2901, Shanghai Shanghai 201106, China. Phone: (86)21-62206683, E-mail: wmzhu69@hotmail.com

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