Chronica Horticulturae

Volume 47 - Number 3 - 2007

A publication of the International Society for Horticultural Science

Horticultural Highlights

Pyrethrum Production: Tasmanian Success Story • Beneficial Plant Pathogens • The Glasshouse, Royal Horticultural Society, Wisley, UK • History and Iconography of Eggplant • Greenhouse Vegetable Production in Canada • Black Sea Agricultural Research Institute in Turkey

Symposia and Workshops

Medicinal and Nutraceutical Plants • Culinary Herbs • New Floricultural Crops • Pear • Breadfruit R&D

ISHS

Chronica Horticulturae

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

Chronica Horticulturae© ISBN: 978 90 6605 520 9 (Volume 47 - Number 3; September 2007); ISSN: 0578-039X.

Published quarterly by the International Society for Horticultural Science, Leuven, Belgium. Lay-out and printing by Drukkerij Geers, Gent, Belgium. All previous issues are also available online at **www.ishs.org/chronica**. Contact the ISHS Secretariat for details on full colour advertisements (1/1, 1/2, 1/4 page) and/or mailing lists options.

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

Cover photograph: The new Glasshouse at RHS, Wisley, UK, a garden under glass, see article p. 14.

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Reaching and Serving the Developing World: Can We Do Better?

Norman E. Looney

Norman E. Looney, ISHS President

The ISHS Secretariat recently heard from a South African colleague making the point that many symposia sanctioned by the Society, while of great interest to scientists living and working in developing countries, are financially out of reach. This struck a very sensitive nerve and forced me to think about how we conduct our business, and more importantly, about how we might do better. I concluded that while there is a solid rationale for continuing with 'business as usual', we must recognize that both Society membership and our symposia are considered too expensive by many colleagues in developing countries. This column enlarges on my reply to that South African colleague.

The tradition of the nearly 100 ISHS Working Groups and our 24 Sections and Commissions is to hold their periodic symposia in those countries where the most active and interested Working Group members reside. Convening these symposia is a big job and only those very interested in the topic and dedicated to sustaining the Working Group are likely to step forward. The reality is that these individuals tend to come from the most developed countries where salaries, facilities and research support are generally good to excellent. It is not often enough that we receive offers from Working Group members living and working in the developing world, although this does happen from time to time and we do everything possible to encourage this outcome. [1]

Secondly, it is important to understand that each of the 30 or more international meetings sanctioned by ISHS each year is self-supporting. The Society exists with income from membership fees and the sale of conference proceedings (*Acta Horticulturae*) to libraries around the world. It receives no funding from foundations, agencies or governments and has never been in the business of supporting individual participants to its symposia. However, some conveners are successful in attracting outside support for the meeting and, together with the income from registration fees, are able to support a few key speakers and sometimes waive the registration fee for some presenters from developing countries. Furthermore, ISHS encourages conveners to offer affordable housing and meal options, often in student housing on university campuses.

It would be wonderful if we could do more than this, and as mentioned below we are moving in that direction, but it is important to recognize that nearly every ISHS symposium does achieve some participation from developing country scientists. These delegates most commonly find support from their government or from an agency for international development. Overall, attendance at our international symposia shows no signs of decreasing.

As of 2006, ISHS had members in 143 countries and about 28% of all members lived in countries classified by the World Bank as being other than 'high income.' These members pay the annual membership fee only in alternate years. ISHS individual membership (now approaching 7000) is growing by about 400 members per year. ISHS also has 50 Country/State Members and fewer than half of these are categorized as being 'high income.' Again, the membership fee is graduated to reflect differences in wealth. Thus, ISHS has a history of making concessions aimed at improving inclusiveness.

Still, the fact remains that we are not adequately reaching and serving a large proportion of the world-wide community of horticultural science professionals. It is estimated that just one low-income country, India, is home to as many as 10,000 potential ISHS members. While many of these colleagues do belong to a national or regional professional society, fewer than 80 hold membership in ISHS. The situation is equally dramatic in China. At least one reason for this is that the ISHS membership fee, even at 50% of normal, is too high for thousands of these colleagues. Even more important in terms of individual professional development and building a nation's capacity to support horticultural industry through research and education, is the fact that too few of these colleagues can afford to participate in our symposia and Congresses.

In 2002, the new ISHS Board of Directors appointed a Committee for Research Cooperation composed of six influential leaders in the horticultural science for development community. These people represented FAO, international centers engaged in horticultural research, and several international agencies conducting or funding horticultural crop research for development. One outcome was the launch of the Global Horticultural Initiative (see www.globalhort.org), which is now led by a consortium of partners including ISHS.

It is through GlobalHort that ISHS hopes to make more rapid progress toward reaching and serving colleagues in the poorest countries of the developing world. It is envisaged that GlobalHort will use a proportion of its donor funding to ensure that more horticultural science conferences can be held in Africa, Asia and Latin America. Likewise, we are hopeful that GlobalHort will be able to provide support for worthy individuals wishing to attend key meetings in 'high cost' countries. Finally, by partnering with other agencies, it seems likely that the ISHS database of horticultural knowledge (at www.actahort.org) can be made available to more of our colleagues unable to afford Society membership.

We need to do much more to address this 'affordability of our products and services' issue, but I believe it is fair to say that ISHS is doing better than other societies serving the international biological sciences community. Unfortunately, there is nothing that we can do about salaries, currency exchange rates, and the high costs of visiting Europe or North America; and we must also recognize that more than 70% of our members live in high income countries and seem content with our offerings.

Ironically, while support for horticultural

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1 As an aside, it is interesting to note that recent statistics suggest we may be turning the corner on this issue. At time of writing this column, 13 of the 36 symposia thus far confirmed for 2008 will be held in countries classified as 'low' or 'low middle' income by the World Bank.

research and education seems to be declining in many industrialized nations, horticultural industry has never been stronger in both the developed and developing world. Furthermore, the potential of horticulture to reduce poverty amongst smallholder farmers, create employment opportunities for landless workers, and improve family and community nutrition is now widely recognized by the international development community.

I believe that the time is right for ISHS to play a more proactive role in building and maintaining a vibrant capacity to deliver horticultural research and education in both rich and poor countries. Our involvement with the Global Horticulture Initiative could prove to be the perfect tool for accomplishing this in the developing world. While it may be some decades before our products and services are deemed fully affordable by colleagues in many developing countries, the situation is bound to improve as these countries and regions gain wealth.

How we can achieve the goal of sustaining horticultural science as an attractive academic pursuit in the world's most affluent countries, countries where it has flourished for more than a century, must be the topic for a future column.

ISHS and *The Journal of Horticultural Science & Biotechnology* (JHSB) Agree to Collaborate in Providing Electronic Access

The Trustees of the JHSB and the Board of ISHS recognise that there is much to be gained through partnership. Commencing 1 January 2008 they will offer collaborative international electronic access to the new knowledge published in *The Journal of Horticultural Science and Biotechnology* (JHSB). Research papers, review articles, features and opinion pieces published in JHSB will be available to JHSB subscribers in electronic format *via* the Society's website and, on an individual payment basis, to non-subscribers. Enhanced opportunities to access back issues of JHSB and to search for specialised topics and themes will be developed.

Arrangements for the publication of JHSB in its paper format will remain the same and continue to be provided by Headley Brothers, Ashford, Kent, UK. Current procedures for electronic processing and the transmission of manuscripts accepted for publication are being amended to align with those of ISHS. In future, subscribers who have previously had electronic access to JHSB *via* Ingenta will be directed to the ISHS website.

Benefits will accrue to JHSB subscribers and to ISHS members from this collaboration. Subscribers to JHSB will benefit from increased access to the wider range of knowledge in horticultural science and other information facilities available through the ISHS website. Society members will benefit from closer access to, and more immediate availability of an eminent peer-reviewed Journal.

The Journal of Horticultural Science and Biotechnology was founded in 1919 and is a leading peer-reviewed, citation-rated Journal of international stature, reputation and eminence (details available at: www.jhortscib.com). It publishes high-quality original research findings in horticultural science and biotechnology to a world-wide audience from its Editorial Office at the University of Warwick, UK. Currently, JHSB publishes approx. 1,000 pages in six issues *per annum*. In 2006, over 400 papers were submitted, of which 35% were accepted for publication. Special Editions are published to mark particular events such as the International Horticultural Congress in 2006, and a forthcoming Special Edition is planned to contain papers from the large EU ISAFRUIT Integrated Project on top fruit. JHSB is an English Charity owned by its Trustees for the benefit of horticultural science and society-at-large, on a not-for-profit basis.

The ISHS already publishes *Acta Horticulturae* and other material electronically. Hence, it is well-placed to support JHSB for the benefit of its members. The Society members will be able to use their credits to download full papers from JHSB as well as *Acta Horticulturae*. This collaboration with the JHSB Trust will substantially increase the comprehensiveness of ISHS information services.

Geoffrey R. Dixon, Chairman of the Trustees of *The Journal of Horticultural Science & Biotechnology*
Norman E. Looney, ISHS President

Issues

Pyrethrum Production: Tasmanian Success Story

Matthew Greenhill

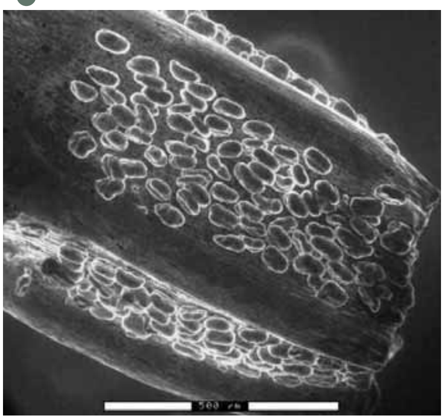
BACKGROUND

Pyrethrum is a natural insecticide extracted from the Composite perennial plant, *Tanacetum cineariaefolium*, Asteraceae. The insecticide pyrethrum contains quantities of 6 esters, collectively named pyrethrins: jasmolin I & II, cinerin I & II, pyrethrin I & II. Pyrethrins are extracted from the daisy-like flowers (specifically achenes) of the pyrethrum plant by processes involving milling of flowers and then extracting and refining of the crude plant oil. The extract is sold as a standardised refined pyrethrum extract, usually 50% refined extract of pyrethrum.

The standardised extract is used by formulating and marketing companies in a wide variety of applications, including as veterinary ectoparasitic treatments, home and garden products (household aerosols, garden insecticides), horticultural products (for protected cropping, certified organic products and general crop use), for disinfestation treatments (e.g. commercial pest control uses in houses and industrial applications) and for public health uses such as mosquito control.

Pyrethrum should not be confused with *pyrethroids*, such as the synthetically produced *permethrin*. The pyrethroids were developed by a research team based at Rothamsted Research Station, in the United Kingdom, from studies of the chemistry of naturally occurring pyrethrins.

Pyrethrum oil glands on the surface of a pyrethrum seed.



Synthetic pyrethroids, in most applications, directly compete with pyrethrum and have led to a general decline in the use of pyrethrum.

The largest market for pyrethrum has traditionally been and remains the USA. However, there are smaller but significant quantities used in the European Union and Asia. The major suppliers on the world market are currently the Pyrethrum Board of Kenya (PBK) and Botanical Resources Australia Pty Ltd (based in Tasmania, Australia). Botanical Resources Australia produces between 30 and 40% of world production and uses the most technologically advanced production system in the world to produce pyrethrum extract.

BOTANICAL DESCRIPTION OF PYRETHRUM

Tanacetum cinerariifolium (Trev.) Schulz Bip., Tancet. 58 (1844)

(*Pyrethrum cinerariifolium* Trev., *Chrysanthemum cinerariifolium* (Trev.) Vis.)

Common Names: pyrethrum, Dalmatian pyrethrum, buhac, pyrethrum daisy.

Morphology: Caespitose, silvery-grey, perennial covered in soft silky hairs. Stems 15-45 cm.

Leaves pinnatipartite, glandular-punctate, lanceolate to oblong, segments pinnatisect to palmatisect, narrowly lanceolate to oblong-lanceolate. Basal leaves 10-20 cm, petiolate. Laminas usually shorter than petioles. Cauline leaves similar but shortly petiolate and usually smaller. Capitulae terminal, solitary and on long petiole. Involucre 12-18 mm diameter with bracts in 3 rows. Outer florets are female with white ligules, ligules 6-16 mm. Inner florets hermaphrodite with 3- to 5-mm long, 5-lobed, yellow corolla tube.

Achenes all similar, 2.5-3.5 mm, 5- to 7-ribbed with secretory lacunae, without epicarpic mucilaginous cells. Pappus an irregularly lobed corona 0.6-1 mm. The pyrethrum achene is the source of over 95% of the pyrethrins contained in the pyrethrum plant. Pyrethrins are located in tiny oil glands on the external surface of the achene (refer to illustration).

Seeding of pyrethrum occurs in late winter.

HISTORY OF PYRETHRUM PRODUCTION

Pyrethrum is first recorded in history at the time of China's Chou Dynasty, some 2000 years ago. The flower was traded along the Silk Route into Europe where it was widely grown in present day Croatia. The Dalmatian region was the predominant pyrethrum-producing region from the late 19th century through to the advent of World War I, when the predominant product was referred to as "Dalmatian Flea Powder".

Japan became the major supplier after 1918 and remained so until 1940. Kenya began production after the introduction of *Tanacetum cineariaefolium* in 1928 and, by 1940, had replaced Japan as the dominant world supplier of pyrethrum extract. Neighbouring East African countries, particularly Tanzania, Rwanda, and Uganda also developed infrastructure to support pyrethrum cultivation and have produced significant amounts of pyrethrum from time to time.

Over time there has been some volatility in supply from East Africa. Periodical shortages due to occasional unfavourable climatic conditions have resulted in the outlay of considerable resources by various parties in the hope of developing other geographical supply zones. To this end, experimental or small commercial plantings are known to have been made in Albania, Algeria, Angola, Argentina, Australia (Canberra and NSW prior to Tasmania), Bermuda, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Congo, Cyprus, Ecuador, Egypt, Republic of Ireland, England, Ethiopia, Fiji, France, Greece, Guatemala, India, Italy, Jamaica, Madagascar, Mexico, Morocco, New Zealand, Nigeria, Palestine, Persia, Peru, Philippines, Puerto Rico, United States, St. Helena, Spain, Sudan, Sweden, Switzerland, Trinidad, Turkey, Russia, South Africa and Zimbabwe (Gnadinger, 1945). Ventures in these countries have largely been unsuccessful for a multitude of reasons. In recent times, apart from East Africa, Papua New Guinea and more recently, Australia are the only countries to develop self-sustaining pyrethrum industries.

Table 1. Production cycle of pyrethrum in Tasmania.

WINTER	June July August	New plantings established in field from seed
SPRING	September October November	Disease control Fertiliser, irrigation Flowering disease control, irrigation
SUMMER	December January February	Harvesting commences, with "windrowing", field drying of pyrethrum flowers Harvesting of windrows when moisture content reduced to less than 15% w/w Harvesting completed. Pyrethrum processing commences.
AUTUMN	March April May	Crop regrowth after harvesting. Post harvest weed control commences.

PRODUCTION OF PYRETHRUM IN AUSTRALIA

Australian pyrethrum is grown exclusively in Tasmania, the most southerly state in Australia. Tasmania is an island state some 240 km south of "mainland" Australia. Tasmania has a geographical area of 68,331 km^2 (similar to West Virginia or the Republic of Ireland). Tasmania lies between latitudes 40° and 44° south, and between longitudes 143° and 149° east. Tasmania has a mild, temperate maritime climate, with four distinct seasons.

Pyrethrum production is concentrated in the north west of the state. This region is bounded to the north by Bass Strait (a waterway separating Tasmania from mainland Australia) and to the south by the central highlands, a mountainous region renowned internationally by bushwalkers and nature lovers. Temperatures on the North West Coast are moderate and consistent with a summer mean maximum of 20°C and winter mean maximum of 13°C. The annual rainfall is around 750 mm, which mainly falls in winter. Soil types are predominately "krasnozem", derived from basalt parent rock.

Winter and spring environmental conditions in Tasmania are important factors for pyrethrum flower production. Research by Dr. Phillip Brown (1992) demonstrated that Tasmanian day length and night temperatures are important triggers to maximise flower production. Both night temperatures and vernalisation trigger pyrethrum to produce a single flush of flowers during the early summer (December). Thus Tasmania, in general, offers an excellent climate for pyrethrum and other "extractable" crops (including a sizeable pharmaceutical poppy industry).

Pyrethrum seedling.

To the outside observer, it may seem incongruous that the major production areas in the world are now Kenya and Tasmania. However, it should be noted that temperature, rainfall and soil type in the Kenyan growing regions are similar to Tasmania conditions. Kenyan production is restricted to more temperate highland areas around Nakuru in the Great Rift Valley. Pyrethrum accumulation in oil glands appears to be affected by high temperatures during flowering as demonstrated in trials conducted in Australia. Temperatures above 30°C are detrimental to pyrethrins accumulation during flowering.

THE HISTORY OF PRODUCTION IN AUSTRALIA

(Casida and Quistad, 1995)

The CSIRO commissioned a series of pyrethrum production trials as far back as 1932. Minor trials evaluating pyrethrum production are recorded in 1932-35, 1944 and 1952 in various locations in Canberra, NSW and Tasmania. These culminated in a press release by CSIRO in 1952 which stated, *"Attempts to grow pyrethrum on a commercial scale in Australia over the past 20 years have failed primarily because production costs were too high to allow the products to compete with imported material from East Africa. CSIRO considers that there is no reason for believing that a further attempt at the present time has any greater prospect of success"* (Bhat and Menary, 1984).

During the 1970s the Tasmanian State Government and the University of Tasmania investigated "alternative" crops with the aim of diversifying Tasmania's traditional commodity-based agricultural economy. The focus of investigation was high value extractable crops including boronia, fennel, peppermint, and pyrethrum. Pyrethrum research by the University of Tasmania commenced in 1978, with Dr. Robert Menary establishing a breeding program. Collections for this program were obtained from germplasm in Europe, Kenya, Japan, PNG and India.

Pyrethrum rosettes in autumn around 6 months after planting.

In 1981 Commonwealth Industrial Gases (CIG) entered into an agreement with the University of Tasmania and the Tasmanian Government to develop a pyrethrum industry. CIG's interest was at that time stimulated by a shortage of East African pyrethrum, which had impacted on their production of "Pestigas," CIG's patented CO_2 delivery system for pyrethrum.

CIG invested significantly in the Tasmanian industry from 1981 until 1996. Considerable advances were made with the mechanization of the industry and developing processing technology. However, in 1996, CIG's parent company, BOC, divested "CIG Pyrethrum." Botanical Resources Australia Pty Ltd (BRA), a consortium of management and staff from CIG Pyrethrum, led by the then Tasmanian Manager of CIG Pyrethrum, Mr. Ian Folder, negotiated with BOC to buy the Tasmanian industry. Today, BRA is a majority Tasmanian owned private company.

PRODUCTION AND EXTRACTION OF PYRETHRUM

East African production is very much dependant on the availability of cheap labour, particularly

Pyrethrum in full flower in December, prior to harvesting.

for the labour intensive processes of propagation and harvesting. Propagation is mostly via vegetative transplants, where existing "mother" plants are split into multiple plantlets and then transplanted by hand. Harvesting is done by hand picking flowers of a specific maturity into hessian bags. Flowers are then dried and delivered to designated collection points for payment. There may be up to 14 pickings per annum from one plot, as flowering in East Africa is asynchronous. Typically, the average pyrethrum plot in East Africa is one acre or less.

Early ventures to commercialise pyrethrum in Australia attempted to adapt East African methods to suit Australian conditions. CIG Pyrethrum and the University of Tasmania developed the initial commercial plantings from 1985 to 1992 effectively by mechanising vegetative propagation. New varieties were introduced through the use of tissue-cultured material, which was then grown to plantlets in a nursery operation. Plantlets were then transplanted into field nurseries where they were grown to 300 mm rosette size and then "split" into 5-8 plants for commercial plantings. Tractor-operated, three-row transplanters were used to transplant these vegetative "splits" in commercial plantings. However, this method proved to be very expensive and also logistically very difficult to coordinate. Vegetative "splits" averaged between 5 and 10 cents per plant or $AUS4000 per commercial hectare.

Similarly, early pyrethrum harvesting looked to mechanize East African flower picking. Prototype harvesters were developed that harvested fresh green flowers using harvester fronts that combed flower heads from plant stems. This method also proved too expensive due to high transport costs associated with "wet" harvesting and the need for expensive commercial drying facilities.

In 1992 CIG Pyrethrum negotiated with its growers to introduce a voluntary Research and Development levy. Introduction of this levy proved to be a pivotal decision for the continuation of the industry. This levy was matched by the HRDC, Horticultural Research and Development Corporation (now Horticulture Australia Limited), to give significant funding for research projects aimed at reducing the cost of production of pyrethrum.

The highlights of the Research and Development Program have been:

- The development of a two stage harvesting process where the crop is first windrowed, to field dry and then harvested using specially adapted combine harvesters.
- The development of commercial plantings from seed based propagation ("direct seeding"). This involved selection of specific cultivars with a high percentage of viable seed, development of seed cleaning and seed treatment capabilities and determination of the best planting densities and timing of planting.
- Improved crop husbandry practices. Projects have included: Investigation of pyrethrum water use and irrigation requirements, weed control research and disease control research.
- Dissemination of information to pyrethrum growers through a network of extension staff.

YIELD IMPROVEMENT IN THE PYRETHRUM INDUSTRY

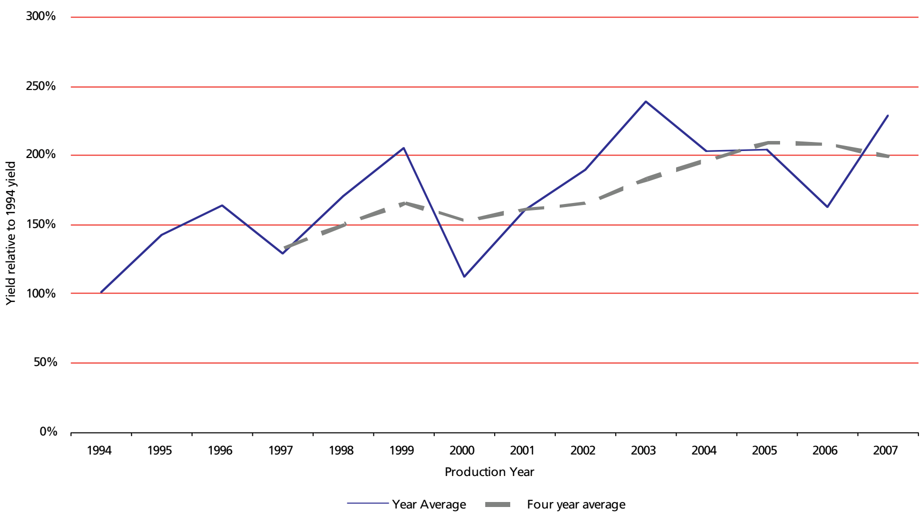
Pyrethrum yields, as measured in kilograms of pyrethrins per hectare at harvest, have more than doubled since 1994 (Fig. 1). This increase in yield is directly attributed to industry investment in Research and Development.

CROP PRODUCTION CYCLE IN TASMANIA

Pyrethrum is a perennial crop that is typically retained for a period of 3-4 harvests. Pyrethrum sowing occurs in late winter from August

Windrowing of pyrethrum commences in early summer (December).

Figure 1. Pyrethrum yield improvement from 1994 to 2007.



Windrowing is followed 10-14 days later by harvesting.

onwards, when soil temperatures and rainfall facilitate seed germination. Pyrethrum, when grown from seed, has a juvenile-like growth phase during which it will not respond to flower inducement conditions. In Tasmania, pyrethrum must attain a critical size and endure a winter before initiation of flowers. This means that the first commercial yield from pyrethrum plants from a winter sowing in 2007 will not be until January 2009. Thereafter, pyrethrum is harvested annually in summer for typically a further 3 harvests.

After the fourth harvest, the normal practise is to terminate the crop with the grower returning to a complementary cropping rotation, based around vegetable crops (such as potatoes, onions, carrots and brassicas) and poppy crops. During the production cycle of the crop, the grower is required to fertilize, irrigate and control any weeds and diseases that may affect crop production. Major diseases of pyrethrum in Tasmania include *Sclerotinia minor, Sclerotinia sclerotiorum* and *Phoma ligulicola.*

HARVESTING AND EXTRACTION

Harvesting of pyrethrum flowers begins in December with the windrowing of pyrethrum flowers. Crops are then harvested using modified combine harvesters. Harvesting equipment is illustrated.

The harvested product is a composite of flower components (predominately achenes) and flower stems. This harvested crop is loaded into trucks and transported to Botanical Resources Australia's factory site for processing. Briefly, the processing of pyrethrum involves: (1) hammer milling and then pelletising the harvested material; (2) extraction of the pellets in hexane (the usable fraction of this process is called pyrethrum oleoresin); (3) pyrethrum oleoresin is "refined", or decolourised, by way of supercritical refining; (4) refined pyrethrum is standardised, usually to 50% pyrethrins using a deodorised solvent as the diluent. Pyrethrum is a natural product and is not changed in any way by harvesting or extraction processes.

THE FUTURE

Pyrethrum is an effective, broad spectrum insecticide. However, the fact that it is an insecticide means that it operates in a highly regulated market. Pyrethrum has been undergoing a review process in both of BRA's major markets - the USA (through the Environmental Protection Agency or EPA) and the European Union (through submission to 91/414 and Biocides directives). As a result of these reviews, registrants and producers of pyrethrum based formulations have been requested to compile a comprehensive safety / environmental package to support continued pyrethrum use.

In the US, the Tasmanian industry represented by BRA has been a member of the Pyrethrum Taskforces, which have included representation from the major marketers and producers of pyrethrum. These taskforces have generated data to meet the requirements of the US Environmental Protection Agency Pyrethrin Review. The data call-in process is in its final stages with the US EPA publishing the Pyrethrins Reregistration Eligibility Document. In general, the US EPA have been supportive of pyrethrum and there have been no adverse effects from the review.

In the EU, BRA has collaborated with a major customer to prepare "dossiers" for the EU directives specific to crop / garden use (91/414) and aerosols / public health (Biocides). These dossiers have been submitted to the Member States for assessment. Reviews of insecticides by regulatory agencies have not only been restricted to pyrethrum. Other insecticide molecules have also been reviewed by the United States Environmental Protection Agency. These reviews have resulted in the withdrawal from the market or severe restrictions enforced on the use of many of these molecules (e.g. insecticides from the organophosphate group).

In general there are reasons to feel optimistic about the future for pyrethrum. Pyrethrins have very low toxicity for humans and warm blooded animals and are rapidly degraded to benign by-products by UV light and air. In recent years as environmental and health consciousness has grown, there has been a resurgence of interest in pyrethrum. However, it should be noted that pyrethrum demands a price premium over synthetic substitutes and there has been a general trend for these substitutes to become cheaper as they move off-patent. Maintenance of the price premium for pyrethrum through continued investment in marketing and product development together with continued investment to reduce the average cost per kilogram

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Beneficial Plant Pathogens

Pi-Yu Huang

Plants infected with plant pathogens usually have a reduction in quality or yield. In many cases, plant diseases have great impact on human life. For instance, in 1845, the late blight of potato caused by the fungus *Phytophthora infestans* destroyed the Irish potato crop, resulting in a million people dying of starvation and malnutrition and more than a million people emigrating out of Ireland. In 1904, the chestnut blight caused by another fungus *Cryphonectria parasitica* was first observed in the New York Zoo, and by 1940, this disease virtually eliminated the handsome and useful American chestnut throughout its natural range in the United States.

Some plants, however, increase their economic values when infected with certain plant pathogens. These microorganisms can be considered beneficial plant pathogens. Examples include the beautiful flowers of some virus-infected tulips and reduced plant size of phytoplasma-infected poinsettias. In addition, some host-pathogen interactions create unusual delicacies, such as *Ustilago maydis* on maize and *Ustilago esculenta* on Manchurian wild rice.

TULIP BREAKING VIRUS ON TULIP

Tulip breaking virus induces the symptom of color breaking on the petals of the tulip. This pathogen acts as an artist that skillfully transforms the healthy solid color of petals to more attractive, variegated colors with spectacular striped, streaked, feathering or flamed patterns. During the 17th century, Europeans fell in love with these virus-infected flowers known as "broken tulips," which caused a wild speculation in tulip bulb prices and a subsequent crash, a phenomenon known as tulipomania.

Figure 1. An enchanting broken tulip amazingly appears in the middle of a lovely and graceful tulip garden. Courtesy of Dr. C.A. Chang, Taiwan Agricultural Research Institute, Taiwan.

Figure 2. Flowers in a Glass Vase by Jan van den Hecke, Flemish, 1625-1684. Oil on canvas. Reproduced with the permission from the Speed Art Museum, Louisville, Kentucky.

The genus *Tulipa* has about 100 species; most cultivated tulips are the cultivars of *Tulipa gesneriana*. The name "tulip" comes from its beautiful blossom that resembles the turban, which translates as *tulipa* in Latin. This lovely and graceful perennial bulbous plant originated from Central Asia, primarily in the Ten-Shan and Pamir Alai Mountain ranges near modern day Islamabad. The tulips were first cultivated by the Turks as early as 1000 A.D., and brought to Europe by Austrian ambassador Ogier Ghiselain de Busbecq in the mid-1500s. Later, Busbecq gave some tulip seeds to his friend Charles de l'Écluse (Carolus Clusius).

Clusius was director of the Royal Medicinal Garden in Vienna, who successfully raised the first European tulips. He left Vienna with his tulip bulbs in 1593 to go to Holland for religious sanctuary. In the Netherlands, Clusius served as chief horticulturist at the Hortus Botanicus at Leiden University and continued to plant tulips for the purpose of medicinal research. Local folks were very attracted to these brightly colored flowers, particularly to the rare broken tulips (Fig. 1). Because Clusius refused to sell the flowers, some desperate buyers broke into his garden, stole some of his tulip bulbs and eventually tulips were spread throughout the Netherlands. Wealthy Dutch and European aristocrats flaunted these beautiful flowers as symbols of power and prestige. Broken tulips were often referred to as Rembrandt tulips, because during the 17th century these fabulous tulips had been a subject in many famous paintings by the Dutch Masters and Flemish artists (Fig. 2).

When the Dutch realized that cultivating tulips or the transaction of bulbs were the quickest way to get rich, many Dutch left their jobs, lovers, and families and became florists and investors. As the madness for tulips spread, the prices of rare broken tulips soared. During the peak of tulipomania (1634-1637), a single bulb of the rare broken tulip 'Semper Agustus' sold for 3000 guilders (around US$1500), which was the price of a large house in Amsterdam. At this period the investor could plant a few bulbs and speculate on their future, trading bulbs like shares and stock. In 1637, when a group of sellers could not get the usual inflated prices for their bulbs, words spread quickly and the market in Holland crashed. Finally, the government forbade speculation in tulips.

The source of magic power for color breaking in tulip was unknown until 1928 when Cayley identified the broken tulip as a virus-infected flower (Lesnaw and Ghabrial, 2000). Several potyviruses are able to infect tulips and cause irregular distribution of anthocyanins, resulting in color breaking. The best known is tulip breaking virus (Fig. 3), which is transmitted by aphids, graft and other mechanical means.

Figure 3. Negatively stained tulip breaking virus. Courtesy of Dr. H.T. Hsu, USDA.

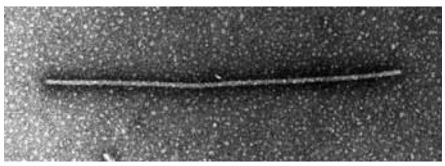
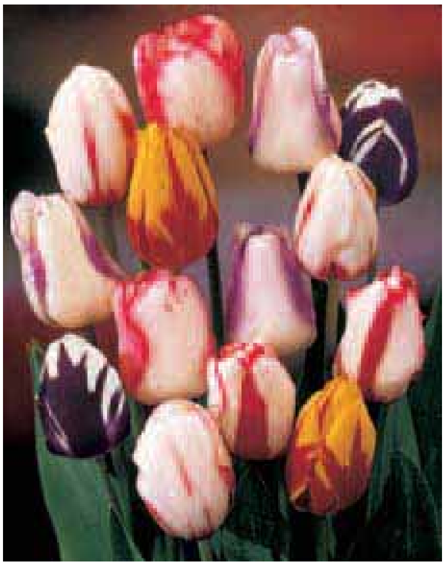


Figure 4. Rembrandt tulip look-alikes mixture. Courtesy of Dutch Gardens, Burlington, Vermont.



Variegated flowers with distinctive patterns, described by Clusius in 1576, were one of the earliest plant viral diseases recorded. Because this virus weakens the infected bulb and gradually leads it to degenerate, the cultivation of broken tulips has been banned.

The Dutch fell in love with tulips at first sight and the tulip has become a symbol for Holland. When the broken tulips sparked tulipomania and almost caused the collapse of the economy of Holland, the Dutch had become skilled in growing tulips and their passion for these most beloved flowers remained unchanged. By the time that beautiful broken tulips were no longer allowed to grow, the tulip cultivators already had the hybridization technique to produce virus-free and genetically-stable Rembrandt tulip look-alikes. In fact the red-and-yellow 'Keizerkroon' tulip was introduced in 1750. Since then, the Dutch hybridizers have worked tirelessly to develop new and lovelier tulips. Today, not only the Rembrandt tulip look-alikes (Fig. 4) but also other lovely cultivars such as the fringed tulip, peony tulip, parrot tulip, fragrant tulip, Queen of Night tulip and many more are available for home gardeners. Holland is the largest producer of flowers in the world and exports more tulip bulbs than any other countries.

THE POINSETTIA PHYTOPLASMA ON POINSETTIA

The poinsettia phytoplasma induces the symptom of dwarfing and free-branching on the infected poinsettia. This pathogen turns a straight and tall, tropical host tree into a lovely compact-sized plant with a multi-flowered canopy, which is convenient for growing in florists' pots. The diseased poinsettia has created an annual multi-million dollar industry, and today is the most common plant found in American homes during the Christmas season.

The poinsettia is also called Christmas flower, Mexican flame leaf, lobster flower, Noche Buena, Pascua, or Christmas star. The scientific name *Euphorbia pulcherrima* means "the most beautiful Euphorbia." The most attractive part of poinsettia plant is the showy bracts, which are modified leaves and often referred to as petals. It does have tiny unisexual, apetalous flowers. A single female flower is surrounded by several male flowers all enclosed in a greenish cup-shaped structure called a cyathium. A cluster of cyathia is in the center of a bunch of large, colored bracts. The poinsettia with the brilliant red bracts against the green leaves is popular for Christmas decoration. In tropical and subtropical regions, poinsettias thrive outdoors (Fig. 5). They may grow straight and up to 10 feet tall. In cold climates, they must be grown indoors.

The poinsettia is a native plant to Central America and southern Mexico. Long before the arrival of Europeans, the Aztecs of Mexico cultivated the plant in the area near present day Taxco and called it Cuetlaxochitl. Because of the brilliant red bracts, the poinsettia was a symbol of purity and beloved by natives and their kings. The Aztecs also used bracts to make dye and made a medicine from the latex of poinsettias to treat fever. In the 17th century, due to the plant's appropriate holiday color and blooming time, the Spanish Franciscan priests near Taxco began to use the bright bracts in the Fiesta of Santa Pesebre, a nativity procession. This is the first recorded use of poinsettias for the Christmas holiday. Since then, poinsettias were used in Mexico to decorate churches at Christmas time and were called *flor de la noche buena* or "Nativity flower."

Poinsettias were first introduced into the United States by Dr. Joel Robert Poinsett (1770-1851). During Dr. Poinsett's tenure as first U.S. ambassador to the newly independent Republic of Mexico from 1825 to 1829, he visited Taxco and became enchanted by the beautiful plants with large red bracts that he saw on the adjacent hillsides. Dr. Poinsett had some plants sent back to his greenhouse in Greenville, South Carolina. Later he propagated the plants and distributed them to botanical gardens and horticultural friends, including Col. Robert Carr. Col. Carr then introduced the plant into commercial trade from Bartram's Garden in Philadelphia. The commercial name for this plant was *Euphorbia pulcherrima* at that time. William Prescott, a historian and horticulturist, gave the *Euphorbia pulcherrima* the new name "poinsettia" in honor of Dr. Joel Robert Poinsett's discovery and devotion. The name poinsettia has become the accepted name in English-speaking countries.

Many cultivars of poinsettia have been selected in the United States and Europe over the years from breeding efforts of a number of commercial horticultural firms with cooperative efforts from various institutions. Most of the principal cultivars of importance were selected and developed by the Paul Ecke Ranch in Encinitas, California. The long lasting cultivar 'Paul Mikkelsen' introduced by Mikkelsen's firm in Ashtabula, Ohio in 1963 and a self-branching cultivar 'Annette Hegg' introduced by Thormod Hegg in Norway in 1967 are also very important.

In the early 1900s the Ecke family of southern California cultivated the wild poinsettia plants in the field and sold them as fresh cut flowers and as landscape plants. By 1923, Paul Ecke selected and developed the dwarfed and

Figure 5. Uninfected red poinsettia plants.

Figure 6. Phytoplasma-infected red poinsettia.

increased auxiliary shoot seedling cultivar. Although the Paul Ecke Ranch's main business was producing field grown poinsettia mother plants for shipping to the growers at that time, Mr. Ecke recognized this new cultivar had great potential for developing an excellent flowering potted plant. In 1945 the Paul Ecke Ranch introduced a more branched selection with more perfect bracts called 'Improved Albert' and in 1963 the first commercial-quality cultivars that grew best as potted plants were introduced. By the mid-1960s most of the Ranch's stock production had shifted from the field to the greenhouse.

Today, the majority of commercial poinsettia potted plants are dwarfed and multiple branched cultivars with long lasting foliage retention. The most popular color is the traditional red (Fig. 6) but different bract colors are available including white, peach, pink, yellow, burgundy, marbled, and speckled.

About 10 years ago, I.M. Lee (2000), a plant pathologist at USDA, Beltsville, MD discovered that the beautiful compact-sized poinsettia potted plants with multi-flowered canopies are actually infected by a poinsettia phytoplasma. This uncultivable, cell wall-less plant pathogenic bacterium (Fig. 7) triggers an imbalance of plant hormones in infected poinsettia, and induces the symptom of dwarfing and free-branching (i.e. developing multiple branches from a single pinch). As a result, this infected poinsettia plant becomes much shorter in stature and produces from five to eight blooms. The phytoplasma can be introduced to non-branching seedlings by grafting and all modern greenhouse cultivars are intentionally infected with the phytoplasma and have become the most important potted plant in the United States.

USTILAGO MAYDIS ON MAIZE

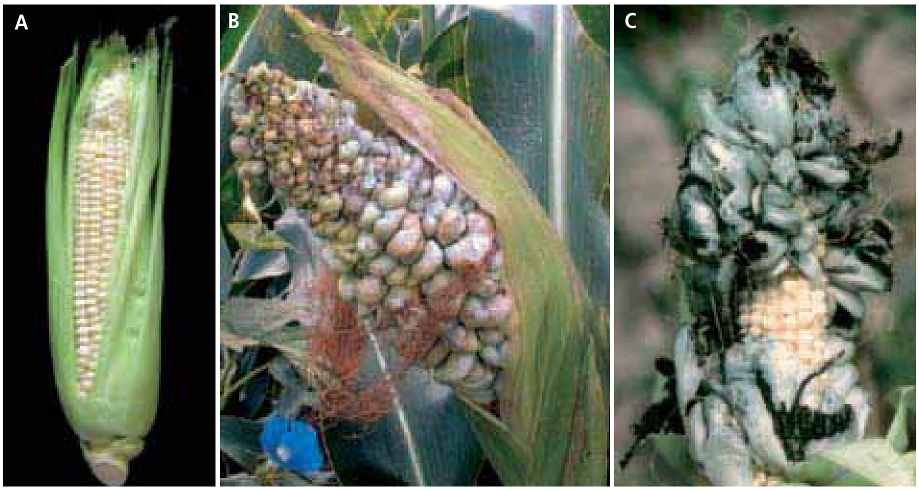
Ustilago maydis is the causal agent of maize smut; this pathogenic fungus is a pest throughout most of the world. In Mexico, however, young galls induced by this pathogen on maize ears are considered a great delicacy known as huitlacoche.

Maize, also known as corn in the US, is an annual grass plant that originated from Mesoamerica. In 1492, when Christopher Columbus' expedition landed in an island of northern Antilles, near today's San Salvador, they discovered that Tainos called their staple crop *"mahis,"* meaning "source of life." During the early 16th century when *mahis* reached Europe, the name of this crop was translated phonetically into *"maiz"* in Spanish and *"maize"* in English. In the United States, Canada, New Zealand and Australia, however, it is commonly called corn, a shortened form of Indian corn. (Corn was the European name for any grain, usually wheat, which resembled salt or *Korn*). Today, corn is one of the four most important crops in the world.

Scientists believed that Mexicans have cultivated and consumed corn for more than 7000 years. The large, deformed, silvery gray kernel-like globule with soft black flesh from corn ear, however, was ambrosia to the Aztecs. They named it cuitlacoche, and cooked it with chilies and the herb "epazote". After the Conquest, Spaniards called it huitlacoche and added garlic and onion to the original recipe. Since ancient times, the price of huitlacoche has been much higher than normal corn (Fig. 8a).

Figure 7. Electron micrograph of phytoplasma bodies in the rice phloem tissue. These cell wall-less bacteria have similar morphology as the poinsettia phytoplasma. Courtesy of Dr. M.J. Chen, Chung-Hsing University, Taiwan.

Figure 8. Corn smut: (A) Normal corn; (B) young galls (cuitlacoche) on corn ear; courtesy of Dr. J.K. Pataky, University of Illinois; (C) mature galls, courtesy of Department of Plant Pathology, North Carolina State University.



As corn flourished in Europe, the disease of this plant also followed. Corn smut became one of the most important corn diseases, and was first observed in Europe about 1750. In 1883 Brefeld demonstrated that the causal agent of corn smut was *Ustilago maydis* (Valverde et al., 1995). This fungus causes whitish galls on ears, stalks, leaves, and tassels. Ears can be completely covered by galls.

Huitlacoche is actually the young fruiting bodies (galls) of *U. maydis* on the corn ears (Fig. 8b). These edible young fungal galls are composed of soft black flesh, which consists of fungal materials and enlarged host cells enclosed by silvery white membranes, and have the mixed flavor of mushroom and corn. As the galls mature, membranes ruptured (Fig. 8c) and fleshy tissues turned into black powdery teliospores (Fig. 9) and may be contaminated with toxic ergot. Therefore, mature galls should not be consumed.

Corn smut in the United States was first reported by Schweinitz in 1822 (Valverde et al., 1995). It was a destructive disease, especially on sweet corn. For years, USDA has spent a considerable amount of time and money trying to control this disease. Recently, due to the development of several resistant sweet corn hybrids, corn smut became less of a threat to the crop. Now, fresh huitlacoche can be sold in the market with a special permit from USDA.

Interestingly, the people in Shandong, China have used the name "young black molds" for huitlacoche. Children like to pick these sweet, edible black molds from corn ears in the field and enjoy them as a substitute for candy. They dislike the old black mold because it tastes sandy and has less sweetness. Tibetans also like to use the young fruiting bodies of *U. maydis* on the corn ears for maintaining the normal liver and gastro-intestine function.

The popularity of huitlacoche has been increased in recent years; it has been marketed in the US as "maize mushrooms," "Mexican truffles," or "caviar azteca". Fresh or canned huitlacoche (Fig. 10) can be prepared in different ways in Mexico cooking (Fig. 11) or prepared with some of the favorite ingredients to create a new cuisine.

Figure 9. Scanning electron micrograph of *Ustilago maydis* teliospores. Reproduced from The Ustilaginales of Mexico, R. Duran, 1987. Washington State University Press. By permission of author.

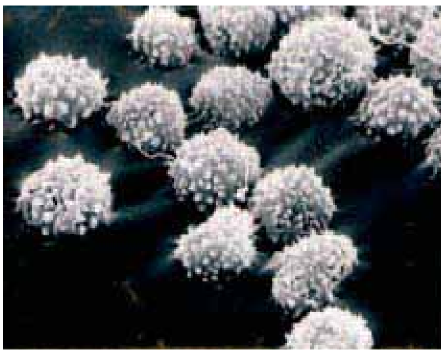


Figure 10. Canned cuitlacoche.

Figure 11. Cuitlacoche sauté. Courtesy of Dr. J.K. Pataky, University of Illinois.

USTILAGO ESCULENTA ON MANCHURIAN WILD RICE

Ustilago esculenta induces the formation of a smut gall on the Manchurian wild rice or water bamboo (*Zizania latifolia*). This fungal gall known as water bamboo shoot is a delicacy treasured by the people in East and Southeast Asia. The parasitism of this pathogen in the host plant is interesting and unique. The stem of Manchurian wild rice without this fungal infection is not palatable. Therefore, farmers have cultivated fungus-infected Manchurian wild rice since ancient times for the purpose of harvesting water bamboo shoot.

Manchurian wild rice is known as water bamboo (Yamaguchi, 1990) and belongs to the same family Poaceae as common bamboo. It is also called *chiao-taso* (Smith and Stuart, 1976) meaning *chiao* grass or *ku* in China and Taiwan, or *makomo* in Japan. This tall perennial aquatic grass is a native plant to China and grows commonly in shallow water in lake, slow-flowing streams, and marsh.

The seed of Manchurian wild rice is called *chiao-mi*, meaning the rice grain of *chiao-taso* or *ku-mi* meaning the rice grain of *ku* in China. It is about 2.5 cm-long with grayish seed coat and has a great aroma. It is used as a substitute for rice or made into a cake and was once an important grain in ancient China. The first record of this grain was 3000 years ago in the *Book of Chouli*, the first book of the infrastructure of Chinese government. *Ku-mi* was one of the six kinds of grains serving the Emperor. Because the grains of Manchurian wild rice matured at different times and scattered easily, they had gradually fallen into disuse and for the last few hundred years became very rare. The Chinese, however, have continued to cultivate this perennial aquatic grass on account of its enlarged, succulent stem as a vegetable.

The enlarged, succulent stem of water bamboo (Manchurian wild rice) is called water bamboo shoot, also known in China and Taiwan as *chiao-pai-sun* meaning the whitish young shoot of *chiao-taso* or *ku-sun*. In Japan, it is called *makomo dake* meaning the young shoot of *makomo*. The Chinese have cultivated and consumed this delicious vegetable for more than a thousand years. Farmers since ancient times have noticed that the plants with flowers (Fig. 12) or those that grew from the seeds could not bear the water bamboo shoots; therefore, they only propagated asexually from the plants with the enlarged, succulent stems (Fig. 13). Through this way of cultivation, the water bamboos grew very productively except for the absence of flowers and grains. They have been cultivated in East and Southeast Asia.

Water bamboo was introduced to Taiwan from China about 200 years ago. Due to the island's climate, good quality water and dedicated farmers with cooperative efforts from the

Figure 12. Uninfected water bamboo plants with flowers. Courtesy of Dr. C.A. Chang and Mr. J.H. Huang, Taiwan Agricultural Research Institute, Taiwan.

Figure 13. **Infected water bamboos with enlarged stems are pulled from the field. Roots and upper leaves will be trimmed and only enlarged stems with husk-like leaves (water bamboo shoots) are kept.** Courtesy of Dr. C.L. Liu, Taiwan.

Figure 16. Light micrograph of teliospores of *U. esculenta.* Courtesy of National Museum of Natural Science, Taiwan.

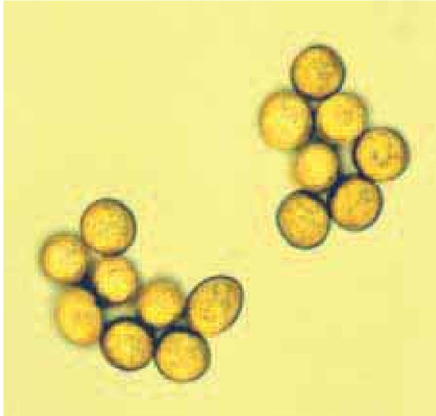
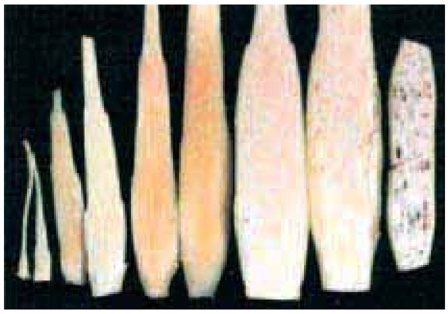


Figure 17. Telia of *U. esculenta* appear as dark brown streaks in the older water bamboo shoots. Courtesy of Dr. K.R. Chung, University of Florida.



research institutes, water bamboo has flourished especially in the town of Puli. Thus, Taiwan has produced the best water bamboo shoot in the world. *Ku-mi* has not been found in this island. Uninfected water bamboo with flower is rare and occasionally can be found in the field and this plant has neither borne the wild rice grain nor produced water bamboo shoot. Thus, farmers called it a "male plant" and discarded it.

For many centuries the formation of water bamboo shoot was mysterious until 1895 when P. Hennings (1895) discovered that smut fungus *U. esculenta* prevents the floral initiation of water bamboo. In 1951 L. Roger (1951) concluded that the water bamboo shoot is a fungal gall resulting from the infection of water bamboo by *U. esculenta*. The plant with flower cannot produce water bamboo shoot and the plant with enlarged stem cannot bloom.

K.R. Chung and D.D Tzeng (2004) and other researchers have found that *U. esculenta* produces the plant hormones IAA and cytokinins that stimulate host stem to increase cell numbers and cell sizes and finally make the stem swollen. At the same time, the photosynthates from the host are translocated to and stored in this modified stem. The cooperation between this pathogenic fungus and host creates a whitish, sweet and succulent edible fungal gall, which contains the fungal mycelia and host tissue, and is wrapped by several layers of greenish husk-like leaves (Fig. 14). Water bamboo shoot must be harvested before the fungus in the edible gall (Fig. 15) develops into the reproductive stage and produces teliospores (Fig. 16). The telia appear as dark brown streaks in the enlarged stem and reduce its flavor and economic value (Fig. 17). The entire water bamboo shoot eventually turns black and decomposed.

Figure 14. Water bamboo shoots with husk-like leaves. Courtesy of Dr. C.A. Chang and Mr. J.H. Huang, Taiwan Agricultural Research Institute, Taiwan.

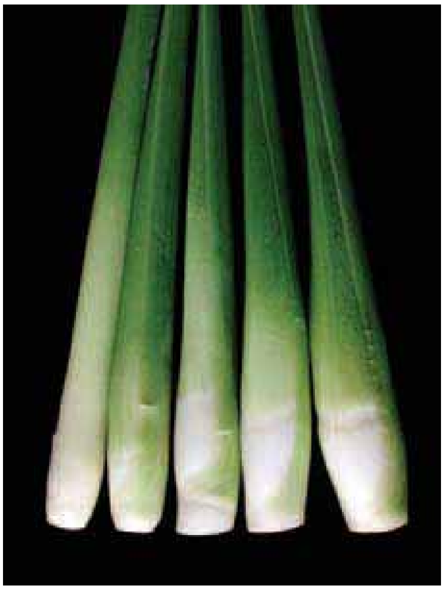


Figure 15. Whitish edible fungal galls (with husks removed). Courtesy of Dr. C.A. Chang and Mr. J.H. Huang, Taiwan Agricultural Research Institute, Taiwan.

Manchurian wild rice (*Z. latifolia*) is closely related to wild rice of North America (*Z. aquatica*). It is conceivable that *U. esculenta* may prevent inflorescence and seed production in *Z. aquatica*. Consequently, the importation of water bamboo shoot to the United States is prohibited.

The crisp and succulent water bamboo shoot looks like common bamboo shoot, but the former has a much softer texture and sweeter taste. Both are interchangeable for culinary uses. People in Taiwan enjoy the water bamboo shoot in several ways; such as salad (Fig. 18), steamed, stir fried, and cake.

Figure 18. **Boiled and chilled water bamboo shoots. They are served as salad after husks are removed.** Courtesy of King Don Restaurant, Puli, Taiwan.

Water bamboo shoot is not only a gourmet food; it is also a medicine for fighting fever. Japanese researchers (Kawagishi et al., 2006) have isolated two osteoclast-forming suppressive compounds from water bamboo shoot and these two substances may prevent osteoporosis.

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Horticultural Science News

The Glasshouse, Royal Horticultural Society, Wisley, UK

Simon Thornton-Wood

After five years of planning, the Glasshouse at RHS Garden Wisley opened its doors to the public on 15 June 2007, and was officially opened on 26 June by Her Majesty the Queen, accompanied by His Royal Highness the Duke of Edinburgh. The Glasshouse celebrates 200 years of the RHS, founded in 1804 at a meeting in Hatchards Bookshop in Piccadilly, London.

The Glasshouse is a garden under glass, with a focus upon horticultural splendour. Through their display, we tell the story of how people have perfected plants: how they were collected, bred and cultivated – developments that are placed in the context of the environmental challenges of today.

The Glasshouse marks a very significant step forward for the RHS in many respects. It has strengthened the profile of the RHS as the

The new Glasshouse at RHS, Wisley, UK, a garden under glass.



Internal landscaping of the RHS Glasshouse.

national horticultural organisation, with world class standards in the cultivation and presentation of plants from around the world. It has been the subject of the biggest fundraising initiative for the organisation in its modern history, raising over £6 million. It provides a special attraction for visitors outside the main garden display season. Most importantly, it has provided an exciting catalyst for RHS plans for education, and especially science education.

The Clore Learning Centre and the Teaching Garden at Wisley were developed as an integral part of the Glasshouse project, providing the opportunity for the RHS to multiply the number of school children that visit the garden and take advantage of high-quality education programmes in an inspiring environment. The innovative 'Growing Lab' perfectly illustrates the approach: a section of the Service Glasshouse dedicated to use for education, with adjustable-height potting benches (for children and adults), and surrounded by those parts of the Service House that hold the Society's rich orchid collections. As they practice their skills, participants can observe the experts at work.

Queen Elizabeth II graciously inaugurates the new RHS Glasshouse.

The Teaching Garden, designed by Cleve West, brings together the components of a garden in a small space – inspiring for schools and others that might consider creating a teaching garden elsewhere, but also providing a practical space in which small children can safely explore and learn, and adults can develop their skills in a real garden setting. Practical gardening brings our concern for the wider environment into a domestic context, for people who may have little direct experience with the substance of our concern: growing food, recycling, wildlife conservation, pollution, and a changing climate.

The Glasshouse itself cascades from a height of 12.5 m (40 ft), presenting three climatic environments: tropical, and moist and dry temperate. The tropical zone is isolated by glass on three sides, but separation internally from the temperate area is achieved mainly by a rock structure, rising to the roof and creating a dramatic internal landscape for the Glasshouse. The temperate zone provides a gradient of humidity from one end to the other, across which the horticultural team find ideal growing conditions for a tremendous diversity of cultivated plants: from tree ferns (at the northern end) to cacti (at the southern end, more exposed to the sun).

Entering the tropical zone, with a minimum night temperature of 20°C, provides an experience of the gardener's jungle ideal: a riot of fantastic shape, colour and texture. A viewing platform extends over the zone, to bring the visitor out among the foliage of the trees and provide a different perspective on the collections.

In the Glasshouse plant collection, 85% has been gathered from the existing stock at Wisley, augmented by specimen trees that have been purchased from specialist suppliers around Europe. In addition, further plants have been given by botanic gardens and a number of RHS members.

The dominating rock structure (actually glass-reinforced concrete, sculpted from moulds of real stone) provides a unique space beneath, to accommodate the Root Zone. Having explored the splendour of the Glasshouse plant collections, the visitor is plunged into an intimate underground space, where life underground is revealed, and its significance to the gardener explained. The Root Zone was designed by Neal Potter, who has developed remarkable museum displays at prominent visitor attractions around the world.

The Root Zone exemplifies the RHS commitment to developing public appreciation of science: the knowledge that must underpin successful gardening. In 2006, the first RHS science education officer was appointed, with a brief to 'open the doors' to the increasingly significant scientific work undertaken by the Society. The Glasshouse has provided further inspiration in this endeavour, with the creation of a 'virtual glasshouse' online, hosted by the UK's principal organisation for science teachers, the Association for Science Education (www.ase.org.uk).

Overall, an area equivalent to ten tennis courts is enclosed (3000 m^2), with 2000 m^2 of service glasshouse. The Glasshouse is set in an inspiring new landscape of sweeping curves, designed by Tom Stuart Smith, and appears to float above the new lake that, in a scheme by Colvin & Moggridge, provides its frontage. The lake itself accommodates 10,000 m^3 of water: enough to sustain the garden a full two months without rain. The entire setting has been transformed from its original low-lying location: the Glasshouse is raised significantly above the natural level of the land, upon the spoil that was removed from the lake. In this way, flooding and some frost protection is gained.

For all its distinctive and inspiring curvilinear design, the Glasshouse is a proven and very cost-effective structure from a Dutch company, Smiemans Projecten, working with architect Peter van der Toorn. High light transmission is achieved with commercial specification glass, which was delivered to the site as flat panels and 'bent' over the pre-fabricated structure.

Over 5000 cultivated plant varieties are displayed in the Glasshouse, and over 600 have earned the RHS Award of Garden Merit (AGM), including *Platycerium bifurcatum*: one individual can be traced back to the Society's garden at Chiswick, which was eventually sold in 1904. Plants are awarded the AGM after being carefully assessed by RHS plant committees, and most have undergone the careful scrutiny of RHS plant trials, to comparatively assess ease of growth, amount of bloom and resistance to pests and diseases. *Begonia* Rex Cultorum Group is an example of the plants that undergo the scrutiny of formal plant variety trial under glass. The resulting Trials Bulletin (www.rhs.org.uk/plants/documents/begonia-rex06LO.pdf) provides gardeners with up-to-date information on the best plants available to them.

The Glasshouse 'plant theatre' shows off special seasonal collections: orchids in January and February, *Fuchsia* in July, *Solenostemon* (coleus) in August, *Nerine sarniensis* in October, charm and cascade chrysanthemums in November. But throughout the Glasshouse, there is a sense of continual change in the displays, bringing out spectacular seasonal collections from the Service House for incorporation into the main structural planting.

Wisley is a place to celebrate people's appreciation for flowering plants, the culture, the trade, and the science that are inspired by that appreciation, and the opportunities that may bring to explore another dimension in environmental education. The Glasshouse at Wisley adds immensely to the excitement of that experience.

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History

History and Iconography of Eggplant

Marie-Christine Daunay and Jules Janick

Eggplant or aubergine (*Solanum melongena* L., Solanaceae), is indigenous to a vast area stretching from northeast India and Burma, to Northern Thailand, Laos, Viet Nam and Southwest China and wild plants can still be found in these locations. Eggplant is a major fruit vegetable with world production exceeding 31 million tonnes (Mt). Leading producers are China (17 Mt) and India (8 Mt), Egypt (1 Mt), Turkey (0.9 Mt), Japan and Italy (0.4 Mt each). Eggplant is particularly favoured in Asia where it has been cultivated for millennia, and in India it is considered King of Vegetables. Greenhouses are preferred to open field in areas of intensive production, such as Spain (Almeria area) and Italy (Sicily), which since the 1980s have specialized in eggplant production for export to Northern Europe, mostly during winter and early spring. Traditional cultivars are progressively replaced by F_1 hybrids for increased yield and stability. Grafting eggplant on tomato or *Solanum* species (e.g. *S. torvum* or *S. integrifolium*) rootstocks is often used in greenhouse production to overcome root diseases. Annual yields of 460 t/ha have been achieved in intensive greenhouse production in The Netherlands, but this is exceptional. There are several related cultivated *Solanum* species also referred to as eggplants, namely the African Gboma eggplant, *S. macrocarpon* (section *Melongena*), and the African scarlet eggplant, *S. aethiopicum* (section *Oliganthes*) (Daunay et al., 2001, 2007). This paper will concentrate on an illustrated history of *S. melongena*.

There is a wealth of eggplant common names. The word *eggplant* in English dates to the British occupation of India, where white egg-shaped fruits were very popular in some areas, although in the UK it is now commonly referred to as aubergine. There are other equivalent vernacular names related to the resemblance of the fruits with eggs such as *Eierfrucht* (German), and *plante aux oeufs* (French). A great number of other names are transliterations from Sanscrit, to Persian, Arabic and Turkish, and later to European languages. Unravelling the linguistic relationship is complex. According to De Candolle (1883) and later authors, *vaatingan* in Sanskrit, *badanjan* in Hindustani are possibly the source of *baadangan* and *badenjan* in Persian; which gave rise to *bedengiam, baadanjaan, melongena* in Arabic; *patlidjan* in Turkish, *badnjan* in Georgian, *tabendjalts* in Berber, *berenjena* in Spanish, *beringela* in Portuguese, and *aubergine* in French. The complexity of the study of eggplant names is illustrated by Arveiller (1969), who devotes 20 pages for a discussion of only French names! *Brinjal*, used in India, derives from the Portuguese *beringela* coined when the Portuguese were the masters of the trade between India and Europe during the 16th and 17th centuries. In the Renaissance the nomenclature became schizophrenic and eggplants were referred to both as *mala insana* (mad apple), the origin of the Italian *melanzana* and the Greek *melitzane*, and *poma amoris* (love apple), a name shared with tomato during the 16th century.

Eggplant was domesticated from wild forms in the Indo-Burma region with indications that it was cultivated in antiquity. Several Sanskrit documents, dated from as early as 300 BCE, mention this plant with various descriptive words, which suggest its wide popularity as food and medicine: *shakasreshta* means excellent vegetable; *rajakushmand* means the royal "melon," *nilphala* refers to the "blue" fruit, *kantavrintaki, kantalu* and *kantapatrika* refer to the spiny character of the plant; *nidralu* refers to the narcotic or hypnotic properties of parts of the plant (Nadkarni, 1927). In the *Ayurvedic*, a Hindi system of medicine, white types were recommended for diabetic patients, and roots for the treatment of asthma (Khan, 1979a). However, *Markandeya-Purana*, ancient Hindu scripture of the 4th century, includes eggplant among undesirable things (Khan, 1979b). Although eggplant images from Ancient India most probably exist, we could not locate any with certainty, and we take this opportunity to request help from our Indian readers.

EASTERN MIGRATION

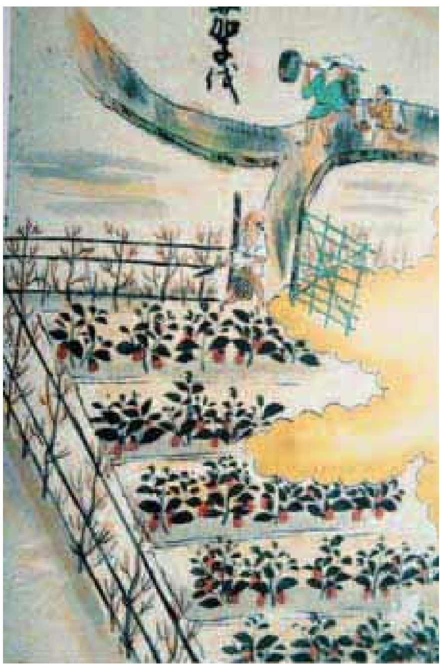
Eggplant was early adopted in China as a vegetable crop, as attested by its presence in treatises such as the *Atlas of Plants in Southern China* written during the Western Jin Dynasty (265-316 CE), the *Qimi Yiaoshu*, a practical handbook of agriculture written at the time of the Southern and Northern Dynasties (420-581) (Z. Xu, pers. commun.), and in the *Ts'i Min Yao Shu*, a work on Agriculture of the 5th century (Bretschneider, 1882, quoted by Hedrick, 1919). Eggplant reached Japan about the 8th century at the time of the Tang dynasty (Allard, 1996).

Li Shihzhen, in his 16th century treatise about medicinal herbs, mentions the existence of fruits with various colors (white, yellow, azure, and purple) but adds that eggplant fruits were not regarded by the Chinese as being free from deleterious properties such as the induction of digestive troubles and uterus injury. He describes medicinal preparations based on fruits, peduncles, roots, stalks and leaves for curing diverse ailments such as abscesses, intestinal haemorrhages, and toothache. The earliest Chinese image we have located is a black and white drawing (Fig. 1) of a small plant bearing two globular and possibly white fruits, part of the *Yinshan Zhengyao* by Hu Sihui (1330), a treatise about the principles of safe food written by the dietician of the Mongol emperor (Buell and Anderson, 2000). Sin Saimdang (1504-1551), mother of Lee Yul Gok, the illustrious Confucian scholar in the Joseon dynasty in Korea, painted beautiful eggplants on a folding screen (Fig. 2) where two plants with oblong fruits are seen, one with a spineless calyx and white fruit and the other with prickly calyx and violet fruits in which the color lightens toward the calyx and is clearly white under the calyx, indicating homozygosity for the recessive allele of the *Puc* gene (Tatebe, 1939; Janick and Topoleski, 1963), which stops anthocyanin synthesis when light is absent. A Japanese illustration of an eggplant field with people harvesting globose dark fruits (Fig. 3) is displayed in an agricultural treatise dated beginning of the 18th century (Doi, 1991).

Figure 1. Chinese eggplant, with globular and possibly white fruits in Hu Sihui, *Yinshan Zhengyao* (1330). Source: Buell and Anderson, 2000.

Figure 2. Korean elongated eggplant on a folding screen by Sin Saimdang (1504-1551). By courtesy of Jung-Myung Lee. Source: International Horticultural Congress 2006, Abstracts book.

Figure 3. Japanese eggplant field with people harvesting globose dark fruits (beginning of the 18th century). Source: Doi, 1991.



WESTERN MIGRATION

Eggplant reached Persia very early but the date is unknown (Encyclopedia Iranica, 1988). The dark purple eggplant was cultivated and the Persian scholar Al Rāzī (or Rhazes, 865-925), the discoverer of alcohol, refers to purple eggplant as a reference color in his chapter on dental diseases (!) in *Ketāb al-hāwī fi'l-teeb*. Eggplant is referred to by the philosopher Abu Ibn Sina (latinized as Avicenna), 980-1037, and other leading Medieval Persian writers on medicine and botany, who often urged caution in use of the eggplant, which was described as the cause of many harmful external and internal effects, as diverse as pimples, ophthalmia, ulcers, impetigo, leprosy, elephantiasis, intestinal constriction and blockage, blood thickening and blackening, insomnia, epilepsy, and excess of black bile. But they also mentioned that beneficial qualities could be acquired by special precautions such as salting and soaking, so that fruit could be used for bile neutralization and ear disease treatment. Eggplant fruits were recommended to be eaten only ripe and cooked.

Eggplant was unknown by the ancient Greeks and Romans but spread throughout the Mediterranean Basin as a result of Muslim expansion in the 7th and 8th centuries. It reached East Africa from Persian and Arab sailors from the 8th century onward as indicated by the presence of many terms for eggplant in Ethiopia (Encyclopedia Iranica, 1988). The Andalusian-Arab physician Abul al Walid Ibn Rushd (known in the West as Averroes), 1126-1198, refers to eggplant as does Ibn Al Awam (12th century) who describes cultivation details in his *Kitab al-Felahah* (Book of Agriculture), both suggesting that eggplant was a common and prized vegetable in Southern Spain in their time. Ibn Al Awam mentions four cultivated types: Egyptian (white fruit and violet petals), Syrian (violet fruit and light blue petals), local (dark purple with a thin calyx and purple petals), and Cordoban (black fruit). Similar types were cultivated in the land of Israel during the Mamelouk period (1250-1517) (Amar, 2000).

EGGPLANT IN MEDIEVAL EUROPE AND BEYOND

Eggplant is quite commonly mentioned and/or illustrated in later Medieval and Renaissance European documents. Albertus Magnus (1193-

Figure 4. Eggplant with ovate violet fruits in *Latin 6823*, folio 106v, 1330-1340. Bibliothèque Nationale de France, Paris.

1280), the great German philosopher, theologian and scientist, mentioned eggplant in his *De Vegetabilibus*, 1256. The first European illustration (Fig. 4) we found is located in an Italian herbal *De Herbis* (referenced as BNF *Latin 6823*, folio 106v) and dates to the 1330s. It displays two foliate branches bearing several large ovate light violet fruits. This fruit type is found in more elaborated miniatures of later manuscripts such as in *Theatrum sanitatis*, a manuscript kept at the Casanatense library in Rome (*Ms 4182* folio 41) and dated ca 1380, where a field of adult plants bearing globose purplish fruits is displayed (Fig. 5) and in *Manuel des vertus, végétaux, animaux* (Austrian National Library, *Ms 2396*, folio 6v) dated ca 1480 where beautifully potted and white fruited eggplants can be admired (Fig. 6), indicating an ornamental use.

Remarkable eggplant images (Fig. 7) are found

Figure 5. Field of eggplants in *Ms 4182* folio 41, ca. 1380. Casanatense Library, Roma, Italy.

Figure 6. Potted ovate eggplants for ornament in *Ms 2396*, folio 6v, ca 1480. Austrian National Library, picture archive, Vienna, Austria.

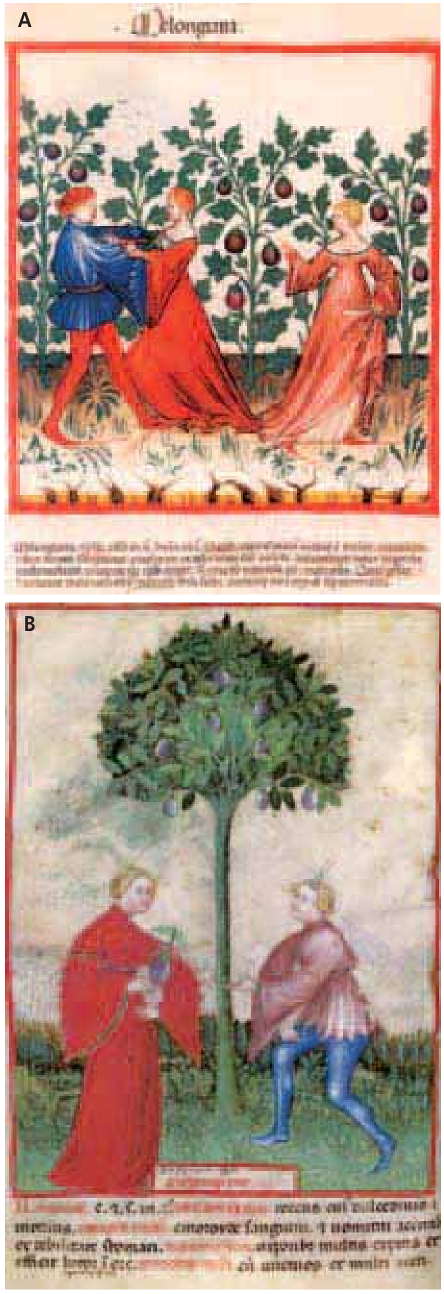
in *Tacuinum Sanitatis* or *Tables of Health*, picture books for aristocratic families of the 14th and 15th centuries derived from the medical treatise *Taqwim al-sihha bi al-ashab al-sitta* (straightening up health by six causes) by the 11th century Bagdad physician Ibn Butlan (Mane, 2006). In the manuscript SN 2644 (folio 31v) held by the Austrian National Library, a field of globose fruited eggplants is the background of a scene where the aphrodisiacal properties of the plant are suggested (Fig. 7A), while an eggplant tree, indicative of extreme artistic license, is found in another manuscript (*NAL 1673* folio 25v) held by the Bibliothèque nationale de France (Fig. 7B).

Clearly, the Medieval European feelings towards eggplant were ambiguous, and included warnings, as well as medicinal, and culinary information. In a late copy (BNF, *ms 12322*, dated 1520-1530) of the *Circa instans* of Matthaeus Platearius (12th century), it was noted that the bitterness and pungency of eggplants turned rapidly into melancholic and angry mood, provoking various ailments, but these ill effects could be reduced by special preparation using salt and rinsing. Eggplant was among the vegetables carried from Spain to America at the time of the Age of Exploration (15-17th centuries), and was reported in Brazil in the mid-17th century (Piso, 1648, quoted by Hedrick, 1919).

EGGPLANT IN RENAISSANCE EUROPE

In 16th century herbals, most black and white woodcuts (but some hand tinted) derive from an image in the *New Kreüterbuch* (1543) of

Figure 7. Eggplant in two copies of *Tacuinum sanitatis*: A. Aphrodisiacal effects of eggplant. Note the lady with her foot on the red gown admonishing the lovers affected by overly romantic feelings. *SN 2644* folio 31v, dated 1385-1390. Austrian National Library, picture archive, Vienna, Austria. B. Fanciful eggplant represented as a tree. *NAL1673*, fol 25v, dated ca 1390-1400. Bibliothèque Nationale de France, Paris.



Leonhart Fuchs (Fig. 8) of a plant with oblong fruits that Fuchs compares to apples. The gorgeous colored illustrations by Oellinger, 1553 (Fig. 9) and Aldrovandi (2nd half of the 16th century) (Fig. 10) still display globular, ovate, and pyriform fruits, white or purple (immature) or yellow (mature). Dalechamps in 1586 first illustrates elongated fruits (Fig. 11).

The aphrodisiacal properties of eggplant are mentioned again by Renaissance herbalists such

Figure 8. Eggplant with oblong fruits in **Fuchs 1543, folio 300.** Municipal library, Ulm, Germany.

Figure 9. Two eggplant types in Oellinger 1553, *Ms 2362*, folios 22 and 444: A. globular white fruits. B. globular purple fruits. Erlangen, Universitätsbibliothek, Germany.

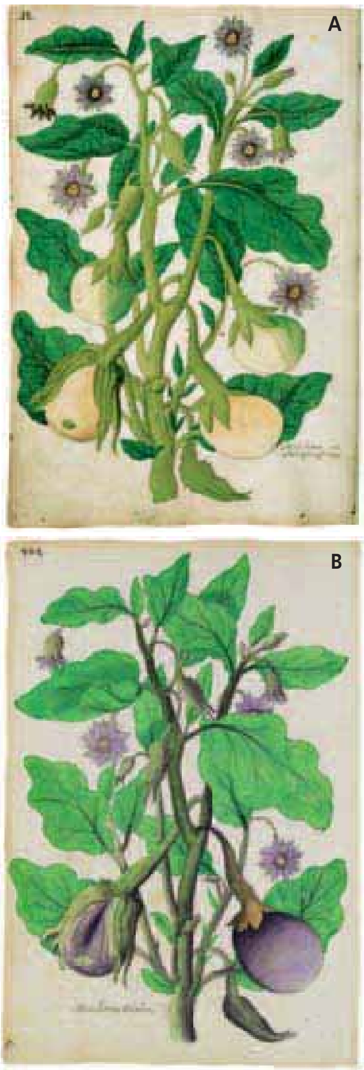


Figure 10. Composite illustration displaying both ovate and pyriform fruit; some purple and some yellow in Aldrovandi, *Il Teatro della Natura*, vol.1-1, folio 53, 16th century. Source: http://www.filosofia.unibo.it/aldrovandi. Biblioteca Universitaria di Bologna, Italy.

Figure 11. Elongated eggplant in Dalechamps (1586). Musée Requien, Avignon, France.

as Matthioli (1544). A French translation (1605) states: *Il y a de nos gens qui mangent les pommes d'amour, pour se rendre plus disposts au ieu des dames* (poetic old French wording meaning people who eat love apples are receptive to flirtation). Though Matthioli details also the disquieting properties of eggplant, he informs his readers as well that eggplant was commonly eaten in Italy. In more Northern countries such as Germany and England, where eggplants did not grow as well, herbalists warned their readers about the dangers of eating eggplants. The English herbalist Gerard(e) (1597) equivocated: *"in Egypt and Barbarie, they use to eate the fruite of* Mala insana *boiled or rosted under ashes with oile, vinegar, and pepper, as people use to eate Mushroms. But I rather wishe Englishmen to content themselves with the meate and sauce of our own country, than with fruite and sauce eaten with such perill: for doubtlesse these apples have a mischeevous quality; the use thereof is utterly to be forsaken. ...Therefore it is better to esteeme this plant and have him in the garden for your pleasure and the rarenesse thereof, then for any virtue or good qualities yet knowne."*

The marvellous festoons in the ceiling fresco of the Loggia of Cupid and Psyche in the Villa Farnesina, Rome, painted between 1515-1518 by Giovanni da Udina, a member of the workshop of Raphael Sanzio (Caneva, 1992), represent a wealth of fruits and vegetables including 31 scattered globose eggplant fruits of a light violet or yellow color (Fig. 12). In 1563 a small purple eggplant was included in the remarkable portrait *Summer* made up of a conglomerate of fruits by Giuseppe Arcimboldo (Fig. 13). Similar ovate, medium sized eggplants, are carved in

Figure 12. Eggplants on the ceiling of the Loggia of Cupid and Psyche, Villa Farnesina, Rome, 1515-1518. Source: Frommel, 2003.

Figure 13. Purple eggplant (ear) in *Summer* by G. Arcimboldo, 1563.

the frame of one of the doors of the Pisa cathedral that date to 1601 (Fig. 14).

Figure 14. Ovate eggplant on bronze door of Pisa cathedral, Italy, 1601. Photo by courtesy of J. Janick.

17TH AND 18TH CENTURIES AND BEYOND

The increasing popularity of eggplant post Renaissance is indicated by the continued richness of eggplant iconography in art up to and including the 20th century. We have located ovate, medium sized and violettish eggplants in paintings by Vincenzo Campi (ca. 1580), Francesco Zucchi (1600), Hendrick van Balen (ca. 1618), Jan Anton van der Baren (1650), Giacomo Francesco Cipper, also known as Todeschini (ca. 1700).

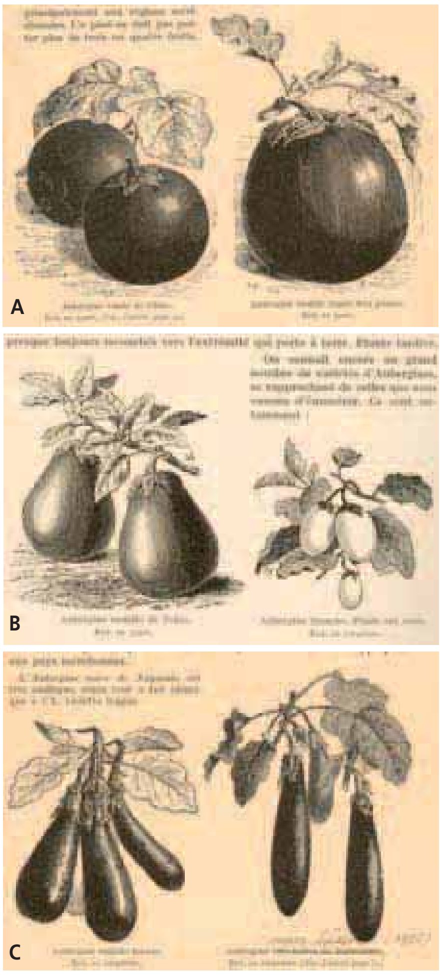
The great period of botanical illustration that flourished during the 18th century gave rise to the production of gorgeous eggplant images (Fig. 15), sometimes hidden in painting details, but also present in florilegia and expensive botanical treatises, usually displaying globose or oblong, purple or white fruits. From the end of the 18th century onwards, another kind of hand drawn or sometimes painted images became available, with the first seed catalogues such as the Vilmorin edition of 1760 (which mentioned eggplant as an ornamental annual). Seed catalogues are a unique source for typifying "old" vegetable cultivars (Fig. 16). In the second half of the 20th century, photographs replaced these drawings. Eggplant, as other vegetables, continued to inspire artists of the 19th and 20th centuries including Emile Bernard (1868-1941), Emile Gallé (1846-1904), Antonio Mancini (1852-1930), and Henri Matisse (1869-1954).

Figure 15. Oblong white and purple types in *Codex Liechtenstein*, vol.5 folios 102 & 104, 1779. Collection of the Prince of Liechtenstein, Liechtenstein Museum, Vienna, Austria.

A

B

Figure 16. Eggplant shapes in Vilmorin catalogue, ed. 1925 (France): A. globular and globose; B. pyriform and ovate (plante aux œufs, on the right); C. elongated.

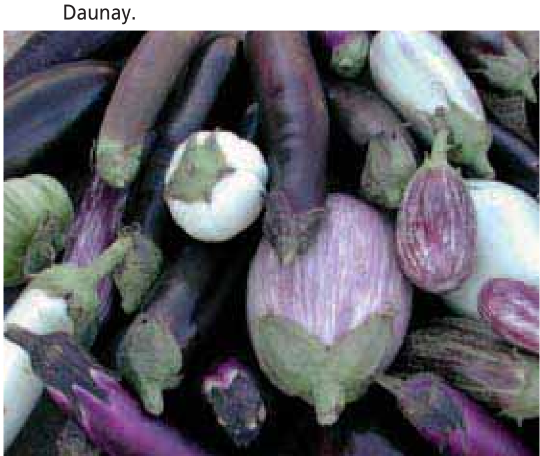


CONCLUDING COMMENTS

The historical literature and iconography we investigated indicates that eggplant has long been common in Asia and Europe as food and to a lesser extent as medicine. The medicinal and aphrodisiacal properties attributed to eggplant seem to be related to the somewhat bitter and piquant flavors of the fruit (spicy food were thought to induce hot bloodedness), and possibly also because it was associated with mandrake, another Old World solanaceous species also bearing globose berries, yellowish at maturity. Yet, most authors sought to alleviate concerns by providing methods to render eggplant harmless in cookery.

The interpretation of the fruit characteristics of cultivars from the past requires some caution. Sometimes the text and illustrations do not match since the writer and artist were often different persons. This is especially true in the hand tinted versions where colors are doubtful, such as the green color of the Fuchs' tinted drawing contradicted by the text mentioning purple and white fruits (Fig. 8). Illustrations and related texts do depict genetic diversity at various historical periods, including fruit size, shape, and color as well as the absence or presence of spines on the calyx, a character that was selected against with domestication. From the early Middle Ages, eggplant iconography clearly reveals the existence of fruit globular to globose to pyriform, medium to large size, and purple (dark or light) or white. The elongated fruit type is represented only towards the end of the 16th century suggesting the introduction of a new form. The iconographic and textual documentation seems to indicate that the fruits were sometimes eaten when physiologically ripe (yellow or brown). The constancy of the cultivar types through time suggests that eggplant, as in tree fruits (Janick, 2005), has not substantially changed for millennia despite the new combinations derived from 20th century breeding in particular for adaptation to new agro-climatic conditions, darker fruits, non-pungent and non-bitter taste, and spinelessness. Fruit striping (Fig. 17) is very rare in the iconographic documents, suggesting a late introduction from the Indian eggplant domestication and diversity center, where this color pattern is quite common.

Figure 17. Eggplant diversity, including fruit striping. Photo by courtesy of M.C. Daunay.



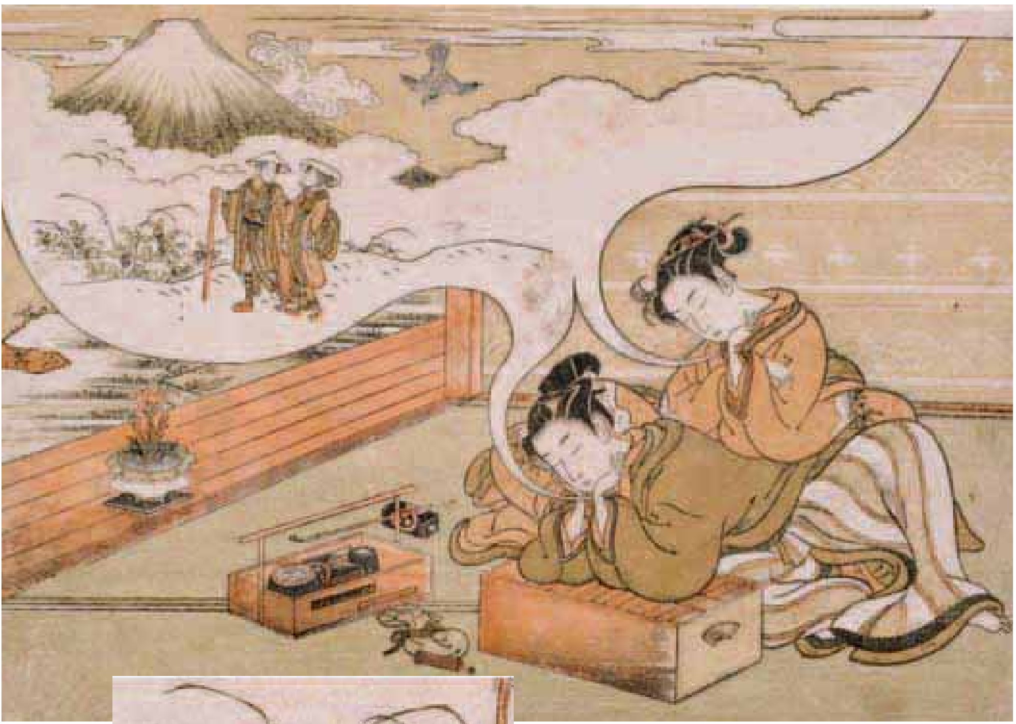


Figure 18. *First spring days.* Nishike-e print/engraving, 18th century, Japan. ©Thierry Ollivier. Musée Guimet, Paris, France. See enlargement of eggplant (left).

Eggplant has entered popular culture, folklore, and poetry. In Istanbul, the southern wind was named *patlican metlemi* (eggplant wind) because it blew on the many fires where eggplants were grilled (Hennig, 1994). In Sicily, eggplant is called *quaglie* (partridge) because its long fruits are often cut by cooks in such a way to resemble wings. A famous Japanese proverb, beautifully illustrated (Fig. 18) says: *the happiest omen for a New Year is first Mount Fuji, then the falcon, and lastly eggplant.* In 1123, the eggplant inspired the poet Ibn Sara of Santarem, Portugal (translated by C. Middleton and L. Garza-Falcon, 1997):

Acknowledgements

The authors acknowledge assistance from the Missouri Botanical Garden (St. Louis, USA), the Botanischer Garten und Botanisches Museum (Berlin), the Universities of Erlangen-Nürnberg and Eichstaett-Ingolstadt (Germany), the municipal library of Ulm (Germany), the Österreischiche Nazional Bibliothek (Vienna, Austria), the Liechtenstein Museum (Vienna, Austria), the Bibliothèque nationale de France (Paris, France), the Musée Guimet (Paris, France), the Musée Requien (Avignon, France), the University of Bologna (Italy) and the Casanatense library (Rome, Italy). The authors are indebted to H. Laterrot (retiree from INRA, Génétique et Amélioration des Fruits et Légumes, Montfavet, France), A. Jacobsohn (Le Potager du Roi, Versailles, France), P. Mane and Ch. von Verschuer (Ecole Pratique des Hautes Etudes, Paris), D. Grail (INRA, Mission Communication Paris), J.M. Bossennec (INRA, Photothèque, Paris) and Jung-Myung Lee (Suwon, Korea) for providing information and images, to L. Laterrot (retiree from INRA, Génétique et Amélioration des Fruits et Légumes, Montfavet, France) for her invaluable help for communicating with Italian libraries, to Julián Cuevas (University of Almeria, Spain) and Paul Hoover (San Franscisco State University, California, USA) for locating translations of the Ibn Sara poem, as well as to E. Jullian (INRA Montfavet) and A. Whipkey (Purdue University, IND, USA) for the management of the images.

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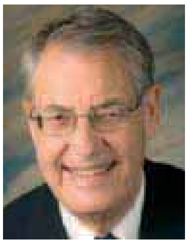

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Greenhouse Vegetable Production in Canada

A.P. Papadopoulos and A. Gosselin

The greenhouse industry is an important and growing segment of the Canadian agri-food industry. Recently, the combined sales of flowers, fruit and vegetables have repeatedly exceeded the Can.$2.0 billion mark putting the greenhouse industry in the same revenue range as canola and wheat, which means that the industry accounts for about 15% of the total crop farm receipts. The demand for greenhouse vegetables from both the US and Canadian markets continues to be high, which has led to record sales and a substantial increase in the area dedicated to production. Vegetable sales out-bid revenues from soybeans and barley and Canada has become the largest producer of greenhouse tomatoes in North America. The introduction of advanced greenhouse technologies has allowed Canada to assume the dominance in the greenhouse vegetable industry; the sophisticated technology and a favorable climate during the March-December season – long hours of daylight and relatively mild weather – generate top average national yields and make the Canadian production a major force in the N. American market. The chief constraint for the Canadian industry is its current inability to produce greenhouse tomatoes profitably during the midwinter period, but research is under way that might remove that obstacle soon.

Map of Canada showing the location of the 18 Research Centres operated by Agriculture and Agri-Food Canada, including the Greenhouse and Processing Crops Research Centre at Harrow, Ontario.

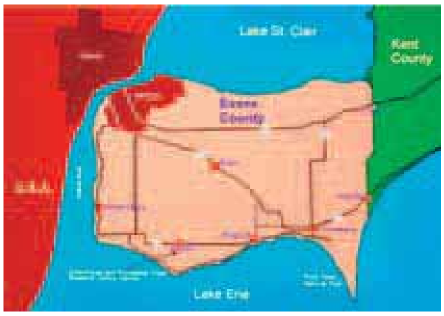
HISTORICAL DEVELOPMENT

It has taken nearly 100 years for the Canadian greenhouse vegetable industry to develop to its present strong position. The industry started in two separate locations (Leamington and Brampton) in Ontario at around 1910-1920, originally comprised of low free standing structures (with primitive steam heating systems, or just space heaters) modelled after similar types of glasshouses common at that time in England.

The Leamington industry was firmly established and by 1950 was about 40 ha; the first plants grown were tobacco and vegetable seedlings. This industry received a significant boost in the early 1950s with the arrival of large numbers of immigrants from Italy who turned their attention to greenhouse tomato production. At the same time greenhouse cucumber production was initiated by large numbers of German-speaking Mennonites who had emigrated from Eastern Europe in the mid-1920s and following the second world war.

By the 1960s, the coal fired boilers were replaced by oil-burning boilers and following the energy crisis of 1973-1974 natural gas was adopted as the main energy source. The 1960s and 1970s were characterized by heavy reliance on greenhouse technologies developed by the Michigan State and Ohio State Universities, and a strong competition between the Cleveland, Ohio and Leamington, Ontario greenhouse growers for the supply of the Quebec market with pink-colored tomatoes. At the same time the seedless cucumber was introduced to the North American market and an Ontario based Marketing Board was established (1968) to assist with marketing.

With the opening of the new facilities at the Harrow Research Centre (now the Greenhouse and Processing Crops Research Centre) in 1974 some innovations were introduced into the design of greenhouse structures and the double inflated polyethylene covered greenhouse was introduced. However, it was not until the late 1970s and early 1980s that two events



Map of Essex county.

prompted immense change. On the marketing front, the North America Free Trade Agreement was signed and the tomato market previously confined to Quebec was now expanded to the entire North America. On the technology front, the introduction of soil-less methods of production to commercial practice allowed the overnight switch from pink to high yielding red tomato cultivars; the production of red tomato cultivars in greenhouse soils had previously been impossible because of lack of resistance to Fusarium crown and rot disease whereas only a limited number of low yielding pink tomato cultivars had been available from the Ohio State University breeding program.

Greatly improved research and development efforts primarily by the Research Branch of AAFC (i.e. The Federal Department of

Agriculture) and technology transfer activities by the Extension Service Department of OMAFRA (i.e. The Ontario Ministry of Agriculture, Food and Rural Affairs) during the 1980s and early 1990s (both, in close cooperation with and significant financial support from the Ontario Greenhouse Growers) laid the foundation for the impressive growth of the Leamington greenhouse vegetable industry in the last decade. Once the industry started to grow, an equally important advertising campaign of greenhouse grown produce helped expand the corresponding markets in Canada and the USA. Other, coincidental reasons for the recent successes of the Canadian greenhouse vegetable sector have been the favourable (low) exchange rate of the Canadian dollar (in relation to the US dollar), an all time low in greenhouse vegetable R&D effort in the USA and an all time low in greenhouse vegetable production in the USA (e.g. the Cleveland, Ohio industry dropped from 300 to 20 ha in the last 30 years). The competitiveness of the Leamington greenhouse vegetable industry was further enhanced by the decision of the great majority of growers to choose the double inflated poly greenhouse during the expansion of the sector, as opposed to the more expensive and energy thirsty glasshouse (most common in Europe, and recently in the USA). The long term survival and strength of the industry was ensured by the active involvement of a new generation of growers who were willing to take over the challenge from an aging group of greenhouse pioneer growers.

On the other hand, operating in an international market, under the free market rules, and without any government subsidies, has had its advantages and disadvantages. For example, the price of natural gas (the main energy source) has constantly been driven up by a strong demand from a multitude of users in the USA and this (one of the leading costs of production) has had a negative impact on the growth of the greenhouse industry in Canada. Also, seasonal imports from a growing industry in Mexico, as well as from many other countries, have sometimes upset the market conditions in N. America.

Overview of the center core Leamington industry.

Table 1. Greenhouse vegetable sales (Can.$ million) - 2005. Official figures from Statistics Canada, Catalogue No. 22-202-XIB, 2005.

Province	Tomato	Cucumber	Sweet pepper	Lettuce	Other	Total [2]
Ontario	205	94	88	x [1]	x	397 (55%)
Quebec	39	4	x	x	x	62 (8%)
British Columbia	127	23	73	x	7	231 (32%)
Alberta	9	15	5	x	x	31 (4%)
Nova Scotia	3	1	x	x	x	5 (1%)
Canada Total [3]	385 (53%)	137 (19%)	166 (23%)	20 (2%)	25 (3%)	727 (100%) (100%)

[1] x = Confidential data, [2] Includes confidential data, [3] Includes all Province

The Greenhouse and Processing Crops Research Centre (AAFC), Harrow, Ontario.

PRESENT STATUS

The greenhouse vegetable industry is an important and growing segment of the Canadian agri-food industry (estimated value: Canadian $200 million in 1994; $1.2 billion in 2006). The latest official statistics (Anon., 2005a) estimated the Canadian greenhouse industry at $2.2 billion and the greenhouse vegetable portion at $727 million (see detailed statistics in Table 1), but, industry analysts claim that the corresponding values in 2006 actually stood at $2.5 billion and $1.2 billion, respectively. The main greenhouse vegetable crops in Canada are tomatoes (425 ha), cucumbers (222 ha), sweet peppers (215 ha) and lettuce (9 ha) (Table 2).

Ontario, claiming more than half the greenhouse vegetables produced in Canada (530 ha, compared to a national total of 869 ha), is a net exporter of greenhouse tomatoes, cucumbers, and sweet peppers to the USA (the Ontario Greenhouse Vegetable Growers estimated that 70% of the Spring 2006 tomato crop was exported to the USA) while it is the main supplier of those salad vegetables to Eastern Canada markets. In fact, Canada has recently become, for the first time in history, a net exporter of fresh tomatoes to the USA.

Although greenhouse vegetables are grown in all regions of Ontario, the major producing area is in the southern part of Essex County, in and around the Town of Leamington. With a 480 ha greenhouse vegetable industry, Leamington boasts the largest concentration of greenhouse vegetables in North America. In fact, industry analysts estimated the Leamington and Ontario greenhouse vegetable industries at 501 ha and 577 ha , respectively (Khosla, 2005).

Other major centers of greenhouse vegetable production in Canada are located in British Columbia, Quebec and Alberta. In general, the greenhouse vegetable industry of Western Canada (primarily in the Fraser River Valley district) differs from that of Eastern Canada (primarily the Leamington district) in the following three important ways:

1. The climate in British Columbia (BC), Fraser River Valley, being a marine climate, is quite moderate resembling closely the climate of The Netherlands. In contrast, the climate of South Western Ontario (Leamington) is typically continental with characteristically cold winters, hot and humid summers, and widely fluctuating light, temperature and humidity conditions.

Table 2. Area of greenhouse vegetables in Canada, in ha. Official estimates from Statistics Canada, Catalogue No. 22-202-XIB, 2005.

Provence	Tomato	Cucumber	Sweet pepper	Lettuce	Total [2]
Ontario	254	154	119	3	530
Quebec	41	17	x	4	62
British Columbia	118	29	90	x [1]	237
Alberta	12	22	6	x	40
TOTAL	**425**	**222**	**215**	**9**	**869**

[1] x = Confidential data, [2] Includes confidential data

Natural gas burning boilers for the heating of commercial greenhouse (Leamington, Ontario).

Double poly greenhouse (Leamington, Ontario).

2. The BC industry lies at a latitude of about 49°N, similar to Northern Europe. The Leamington industry (42°N) is about the same latitude as that of the Northern border of California or Rome, Italy. It follows that day length and similarly affected weather parameters would be different between BC and South Western Ontario.
2. The BC industry is modeled closely on European technology, with a large part of it made up of typical Venlo style glasshouses. The Leamington industry is modeled on a blend of European and North American technology with a large part of it made up of double inflated polyethylene covered greenhouses (Canadian design).

Because of these differences the greenhouse industries of BC and South Western Ontario are distinctly different (the Quebec and Alberta industries being somewhere in between) with different problems and opportunities.

The raised gutter system.

Significant new greenhouse vegetable production technology that was transferred to commercial producers has been primarily responsible for dramatic yield increases over the last 15 to 20 years, estimated at 200-300% for tomatoes and cucumbers (Anon., 1990, 1993, 2005b; Papadopoulos, 1991a,b, 1994a,b).

TRENDS IN THE GREENHOUSE VEGETABLE SECTOR

Product quality and safety are seen as key elements on which to build the strength of the greenhouse vegetable market. Despite the occasional problems of the greenhouse vegetable industry, the long-term prospect looks promising when one considers their market potential in North America. The optimism about the future is derived from a comparison of the levels of fruit and vegetable consumption in North America with those of the Europeans. Statistics show, for example, that Europeans consume ten times the cucumbers that Canadians eat and 100 times the cucumbers that Americans consume. The on-going change in consumer preferences towards fresh, natural, healthy foods can be expected to result in increased demand for greenhouse vegetables. Furthermore, it is proposed that the future prosperity of the Canadian greenhouse vegetable industry lies largely in the US market because of the untapped consumer potential of big cities like New York, Boston, Detroit and Chicago. It is widely believed within the industry that a lot of work can be done in North America to stimulate the consumption of greenhouse vegetables. The flourishing greenhouse ornamental industry in both Canada and USA, and its reliance on the benefits of promotion, advertising, information, research, and education is seen as an example to be followed. Given the market potential, a continuous research and technology transfer effort will be required to ensure high production efficiency and marketability of the final product.

GREENHOUSE VEGETABLE RESEARCH

The Greenhouse Vegetable Research Team at the Greenhouse and Processing Crops Research Centre (http://res2.agr.ca/harrow/index_e.htm) supported by Agriculture and Agri-Food Canada in Harrow, Ontario, with plant physiology, plant pathology, entomology, and greenhouse environment control inputs is the largest of its kind in North America. Specialized research facilities on-site and close proximity to the largest concentration of greenhouse vegetables in North America have offered, for several years, near ideal conditions for the conduct of truly mission-oriented research and have allowed Harrow to emerge as an internationally recognized centre for greenhouse vegetable research. Other human resource inputs into greenhouse vegetable research in Ontario are presently at the University of Guelph.

On a national basis, a second equally important research program on greenhouse vegetables is supported by Agriculture and Agri-Food Canada at the Pacific Agricultural Research Centre (http://res2.agr.ca/parc-crapac/agassiz/index_e.htm) in Agassiz, BC and a new smaller program at Laval University in Quebec City, Quebec. The Agriculture and Agri-Food Canada (AAFC) greenhouse vegetable research program at Agassiz, BC had its origins at the Saanichton Research Station, which had achieved international recognition in the 1970s for its pioneering work on sawdust as a growing medium. The program at Agassiz serves the greenhouse vegetable industry of BC (and Alberta).

Major centres of greenhouse vegetable research are also maintained by Laval University and McGill University (MacDonald College) in Quebec. The program at Laval University was strengthened considerably in the last 15-20 years. The establishment of the Horticultural Research Centre (www.crh.ulaval.ca) under the leadership of A. Gosselin was certainly a turning point for greenhouse vegetable research and training in Quebec (Reed, 1987). In fact, Laval University trains and graduates, by far, the largest number of graduate students (including many from foreign countries) specializing in greenhouse vegetables than any other University in Canada (and likely in the USA).

Significant research programs on several aspects of greenhouse vegetable production and protection have also been supported by the Alberta Department of Agriculture, Food and Rural Development at the Crops Diversification Centre South (http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/opp10713) in Brooks, Alberta, and the Crops Diversification Centre North (http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/cdc5230) in Edmonton, Alberta.

In addition to publicly funded research programs on greenhouse crop production and protection significant research activity on these crops is also supported with private industry funds; major sources of funding are the Ontario and BC grower organizations but also individual growers and horticultural suppliers.

Crop Management, Physiology and Greenhouse Environment

Improving vegetable crop yields and product quality by optimizing the greenhouse environment and the supply of water and nutrients to the crops is vital to a sustainable environmentally acceptable greenhouse industry. The generation of new knowledge and technology for the development of integrated crop management systems leading to high production efficiency and marketability of greenhouse vegetables with minimal environmental impact is considered essential.

The development and demonstration of crop management strategies for the production of greenhouse tomatoes and cucumbers in double polyethylene houses in Ontario has resulted in the construction of exclusively plastic houses, for many years, with significant savings in capital and maintenance costs. It is estimated that at least $500 million were saved in construction costs, compared to glasshouses.

Modifications to the plant root zone can significantly improve crop performance. The adoption, modification and demonstration of soil-less methods for greenhouse vegetable production has resulted in significant yield increases, energy savings, and reduction in the use of chemicals.

Water availability is another aspect of the root environment that is extremely important, influencing both yield and quality. Currently, irrigation needs in commercial greenhouses are assessed on the basis of light interval (or accumulated lux), coupled with a measure of the amount of leaching, or overdrain that occurs in a given time period. A more precise way to administer water to the crop would be to actually use a measurement of the crop water status to set irrigation schedules. The development of the Harrow Fertigation Manager, a computerized miltifertilizer injection system, allows the precise mixing and delivery of nutrients to a variety of crops; making it possible to develop and implement seasonal fertigation programs for all main greenhouse vegetable crops (Papadopoulos, 1998).

The development of new product lines and new crops is becoming increasingly important to the greenhouse vegetable industry. The industry is seeking production information about specific new crops to be grown in soil-less culture. Equally important is the need to develop integrated systems for the production of organic greenhouse vegetables for there is a growing market for organic produce.

With the establishment of provincial environmental guidelines for greenhouse growers, many aspects of commercial growing must be changed to meet these new standards. To reduce the possibility of ground water contamination arising from greenhouse effluent, growers must explore new options such as nutrient recirculation, reuse of effluent on alternate crops, or reduced fertilizer concentrations in the root zone.

In addition the greenhouse industry must address the vast amount of non-degradable waste material coming from greenhouses. For example, the most popular growing medium throughout Canada is rockwool, which at present can only be disposed off in landfills. BC vegetable growers also use sawdust, which is more environmentally friendly but unavailable in other areas of the country. A study is underway to develop new, biodegradable growing media, which can be accessed anywhere in Canada, and possibly become an exported product.

Perhaps foremost in the minds of greenhouse vegetable growers is the need to produce a high quality product. Although the quality of greenhouse vegetables sold at the retail level is already quite high, better automation of grading lines and better post harvest storage technology could greatly enhance the industry's image at retail outlets.

Entomology

The greenhouse industry, in the near future, wishes to produce all crops without the use of chemical pesticides. From the industry's perspective, marketing a pesticide-free product allows it to expand both its domestic and foreign markets, and remain a competitive and viable food industry, particularly with the environmentally-conscious consumer. To achieve this objective, growers require new and/or improved non-chemical control measures for insect and mite pests on their crops, particularly tomato. In addition, the development of cost-effective, precision-level monitoring programs for pest densities and the subsequent development of economic thresholds for pest damage are crucial for determining the cost:benefit ratio for pest management and reducing the rate of pesticide use. Management strategies for insect and mite control must also be integrated with disease management and the other aspects of production if growers are to produce a high quality, pesticide-free product. This integration of crop protection and production strategies can be achieved by using decision-support system computer programs to assist the grower in accessing and interpreting information and in implementing non-conflicting recommendations (Clark et al., 1994; Papadopoulos et al., 1997).

Modern packing house.

Plant Pathology

Commercial greenhouse operations aim at supplying high quality, high value products to specific markets. Plant diseases are an ongoing problem in the production of greenhouse crops, affecting both yield and quality of the commercial product. Since the late 1980s epidemics of diseases such as botrytis and corky root of tomato, powdery mildew and penicillium stem rot of cucumber and Fusarium stem and fruit rot of pepper have caused estimated losses of up to 50% (in specific greenhouses in some years). As well, low levels of these diseases and others such as Didymella fruit rot and Pythium crown and root rot of cucumber occur every year, causing grower losses even in relative "disease-free" years. Other losses occur through consumer reaction to the expression of post-purchase disorders in greenhouse vegetables. The potential for restricted export opportunities on produce treated with certain fungicides could also result in economic losses. All these diseases are recognized by the greenhouse vegetable sector as serious concerns. The use of resistant varieties for some of these diseases is being pursued by the large multinational seed companies, but such resistant varieties have not always been accepted by the growers due to problems with yield and quality. Fungicides can also be used to control some of these diseases, but there are not very many fungicides registered for use in greenhouse crops and use of fungicides in a greenhouse environment may interfere with insect biological control programs (biological control programs for insects and mites are widely used in greenhouse vegetable production). Non-fungicidal control techniques for fungal pathogens are needed to aid the growers in providing a steady supply of high quality greenhouse produce in an environmentally-friendly and sustainable manner. Modification, with accurate monitoring, of the microclimate could achieve substantial reduction in the incidence of leaf, stem and fruit diseases.

Modern technology, which has led to greatly improved yields in the last decade, has brought previously unrecognized stresses to the plant, making it susceptible to new diseases such as Penicillium stem and fruit rot in cucumbers, root death especially in cucumbers, and Fusarium stem and fruit rot in peppers. This problem has to be addressed from the physiological viewpoint as well as from the pathology aspect.

Recirculation of hydroponic nutrient solutions is being implemented by commercial greenhouse vegetable growers to alleviate environmental problems and to reduce fertilizer use. The potential rapid spread of root pathogens in these systems is a major concern and little is known on the epidemiology of root pathogens in recirculating culture, and how to control them without fungicides.

NEW TECHNOLOGIES

Raised Troughs

The raised troughs (or gutters, as are better known in Europe) system, by its name is a system of growing plants on a series of raised platforms 30 to 100 cm above the floor of the greenhouse. The associated benefits are that an increased air movement around the plants is facilitated resulting in less disease, a more level growing surface is achieved resulting in more uniform crop growth, collection of excess nutrient solution and recycling is made much easier, work is at waist height and therefore workers do not have to work as hard, intercropping and the use of artificial lighting become more practical, and yield and fruit quality are improved. According to Dave Orosz (an account manager with Farm Credit Canada, based in Essex, Ontario; Orosz, 2005) a payback on investment in less than two years can be expected with tomatoes making this technology very attractive. All new greenhouses in the last few years have been ordered with raised troughs.

Largest hydroponic lettuce operation in the world (Quebec).

Recirculation

This involves the collection of the excess nutrient solution, its treatment and reapplication; the treatment includes the adjustment of the nutrients and the purification of the nutrient solution. Preventing the release of excess nutrient solution from running away into the environment will soon become mandatory by law in Ontario (The Nutrient Management Act) but many growers have acted proactively. Certainly, all new greenhouses are built with a capacity to recirculate. Recirculation requires the installation of extra piping, large holding tanks, and a purification system for the spent nutrient solution. Based on the assumption that recirculation will achieve a 25-30% reduction in water use and a 40-50% savings in fertilizer costs, Dave Orosz has estimated a 1.5-4.0 year payback of investment in this technology. Some of the older facilities are retrofitting nutrient solution recirculation systems with good results.

Carbon Dioxide Recovery/Hot Water Storage

This technology is based on running a boiler during the day time even when heating is not required to generate carbon dioxide for direct feeding to the crop; the hot water generated is stored in large insulated tanks and used in the night to heat the greenhouse. The cost of equipment required is fairly high but so is the benefit. Dave Orosz has reported that for a 4 ha operation the payback of such an investment is 2-5 years, but for an 8 ha operation the estimate is reduced to 1-3 years. This is just another reason why it is generally recommended that new greenhouse operations should have a minimum size of 4 ha to be economically viable.

Grow Pipe

In the original version of the technology, as used in Europe, an extra heating pipe of a smaller diameter than usual is placed in close proximity to the growing tips of the plants; ideally the grow pipe is gradually raised automatically as the plants grow. The benefit is that heat is transferred by radiation to the growing tips of the plants (growth is directly proportional to temperature) allowing for a reduction in greenhouse air temperature and therefore in overall energy savings. In the most common form of the technology, as applied in Ontario, the grow pipe is stationary at some distance above (or below, or both) the raised gutter. The anticipated benefits are a better (drier) microclimate around the lower part of the plants (less disease), faster fruit growth and ripening, and some energy savings. This is the last of four technologies investigated by Dave Orosz, and he concluded that growers investing in this technology should expect a 3-5 year payback period.

Commercial use of artificial lighting (Quebec).

Glasshouses

Following the widespread use of the inflated double polyethylene greenhouse in the last decade, a new trend surfaced a couple of years ago for the use of glass covered greenhouses; in 2004, about 47% of the 62 ha of new greenhouses built in Ontario for the production of greenhouse vegetables were of the glass type. The increasing popularity of glass covered greenhouse has been brought about by an apparent bridging of the traditional gap in price between plastic and glasshouses as well as by an ever increasing pressure on the industry to extend production into the winter months. The incorporation of an energy curtain in the new glasshouses is seen as an equally effective energy conservation technology as the high insulation offered by the double poly greenhouse. However, the recent sharp increases in energy prices are forcing many growers to abandon any hopes of growing a crop in the middle of the winter (i.e. without supplemental lighting) and the popularity of the glass covered greenhouse might prove short lived. Furthermore, innovative developments (e.g. high UV light transmittance for better bumble bee navigation, low Infra Red light transmittance for energy efficiency, and improved anti-condensate properties for less water dripping) in the area of greenhouse plastic covers are taking place at an accelerating rate making the plastic greenhouse once again a good choice.

Grafted Plants

Grafting is now used extensively to achieve more vigorous plants; such plants are more likely to have healthier and stronger root systems, able to fight off root diseases that are a bigger threat in closed hydroponic systems. The most popular tomato rootstocks are 'Big power', 'Maxifort' and 'Beaufort'. Specialized operations have being established for the raising of transplants that can also perform grafting in large scale.

New Cultivars/New Crops

According to Mr. S. Khosla, Greenhouse Vegetable Crop Advisor with the Ontario

Tomato crop on sawdust (BC).

Ministry of Agriculture and Food, located in Harrow, Ontario (Khosla, 2005), the most popular beefsteak-type greenhouse tomato cultivars in Ontario are 'Dundee', 'Macarena', 'Heritage', 'Big Dina', and 'Grow Dina'. These cultivars are replacing the traditional 'Rapsodie' with a promise for high yield and improved product quality. Of the cluster-type (or tomatoes on the vine), 'Clarance', 'Trusco', 'Freesbie', 'Tricia' and 'Grandella' make up to 45% of the greenhouse tomato production. Other tomato types, such as cherry-type, cocktail-type, and roma-type are also grown in small scale. New crops that have been tried successfully are climbing beans and eggplant. Organic growing is extremely limited.

Alternative Fuels

The present high energy costs and the prospect for even higher energy prices in the future are a major concern for growers and a strong incentive to search for alternatives. A small number of very large, and expensive, boilers have been installed for the heating of greenhouses with various forms of sawdust and/or wood chips.

EMERGING ISSUES

Canadian vegetable growers are now facing very strong competition from Mexican and/or American growers from some Southern States as a result of increased costs of energy and labor in Canada and a strong Canadian dollar. Furthermore, growers in southern areas are in better position to grow vegetables almost all year long when they locate their operations at high altitudes. However, on the long term, food safety and bioterrorism issues may favour Canadian producers who can grow crops in confined environments of remote northern areas. Above all, the Canadian greenhouse vegetable growers count for the survival of their industry on their own competence and their demonstrated ability to succeed in a free economy market without any distortions from government subsidies and incentives.

The PARC at Agassiz, BC.

TECHNOLOGY TRANSFER

Education is a Provincial responsibility in Canada, and so is agricultural extension. In Ontario, a greenhouse vegetable specialist (Mr. Shalin Khosla) and a greenhouse crop IPM specialist (Ms. Gillian Ferguson) advise greenhouse vegetable growers on crop production and protection issues. They are conveniently located at the GPCRC (Harrow, ON) but serve the entire province of Ontario. Having the office of the Provincial greenhouse crop advisors at Harrow puts them under the same roof with the Federally employed scientists working on greenhouse crops and close to the Leamington based growers. Other Provinces with significant greenhouse vegetable industries (i.e. B.C., Quebec, Alberta, and recently, Saskatewan and Nova Scotia) have their own greenhouse crop advisory services. The role of the Federally employed scientists in technology transfer is in supporting the Provincial extension personnel with up to date information, speaking at grower conventions, publishing articles in trade journals, speaking at grower seminars, and occasionally meeting and advising individual growers or groups of growers.

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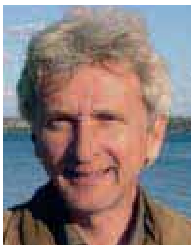
ABOUT THE AUTHORS

Tom Papadopoulos



Andre Gosselin

Dr. A.P. (Tom) Papadopoulos is a Senior Research Scientist at the Greenhouse and Processing Crops Research Centre of Agriculture and Agri-Food Canada in Harrow, Ontario, specializing on greenhouse vegetable physiology and management, and an Adjunct Professor at the Universities of Guelph, Laval and Windsor and a past president of the Canadian Society for Horticultural Science. Email: papadopoulost@agr.gc.ca

Professor Andre Gosselin has been a staff member at the Université Laval since 1984. Dr. André Gosselin founded the Centre de Recherche en Horticulture in 1990 and co-founded the Institute on Nutraceutical and Functional Food in 1997. Email: Andre.Gosselin@fsaa.ulaval.ca

Black Sea Agricultural Research Institute in Turkey

Semiha Güler

Map of Turkey.

Karadeniz Tarimsal Arastirma Enstitüsü (KTAE) is one of the Turkish Agricultural Research Institutes. Founded in 1944 under the name of "Samsun Seed Breeding Station," the institute joined with "Regional Plant Protection Research Institute of Samsun", and was reorganised under the name of "Black Sea Agricultural Research Institute" in 1987, with revised responsibilities. The Institute has a total 116 ha land area of which 92 ha is used for research and production purposes. Research responsibilities area of the institute consists of all coastline provinces from Zonguldak to Artvin. The area also includes Kastamonu, Amasya, and Tokat Provinces situated in the Central Transition Region.

The Institute aims to produce alternative agricultural technologies appropriate for farmers. Various studies have been conducted at both the station farm and different parts of the region. The polyculture system in the region necessitates studies on several crops. The Institute has collaborative studies with some international research institutes such as CIMMYT (International Maize and Wheat Improvement Center), ICARDA (International Center for Agricultural Research in the Dry Areas), CIAT (International Center for Tropical Agriculture) etc. The Institute carries out its researches under five departments: Plant Breeding and Genetics; Agronomy; Horticulture; Plant Protection; Economics and Farming. Breeding studies have been carried out in many crops including wheat, maize, rice, drybeans, chickpea, soya bean, canola, fresh bean, cabbage, red pepper, apple and persimmon.

The Horticultural Department of KTAE performs its studies under three divisions: fruit crops, vegetable crops, and floriculture.

FRUIT CROPS

KTAE is responsible for the Black Sea Region of Turkey; one of the most important fruit gene centers. Research studies have been conducted with all fruit species grown in the region including apple, peach, plum, and persimmon. The key fruit breeding studies include apple, persimmon, and cherry laurel (*Prunus laurocerasus*). The first fruit breeding study was initiated in 1997 with clonal selection in 'Amasya' apple, which is the most preferred and widest grown cultivar both by consumers and producers due to its good taste and long shelf life. However, production of this cultivar has decreased in recent years due to reduced grower interest due to alternate bearing. With the support of Amasya Province Governship clonal selection was launched in 1997. From 51 types of clonal selections from Amasya, Tokat and Samsun provinces seven were found with no alternate bearing. Fruit breeding studies are also carried out with persimmon (*Diospyros kaki*), cherry laurel and strawberry tree (*Arbutus unedo*). These studies cover characterisation and preservation of types collected from the Black Sea Region and different parts of Turkey. The Institute is the coordinator of National Persimmon Studies. Studies on genetic preservation and characterization of strawberry tree (*Arbutus unedo, A. andrachne* L.) will be initia-

New cultivars from the Black Sea Agricultural Research Institute.

ted in this year. Most of these studies have been conducted with the co-operation of Universities and other research institutes.

The Horticultural Department also carries out research on organic strawberry growing and fruit adaptation studies with apple, pear, cherry, sour cherry.

VEGETABLE CROPS

The key vegetable breeding studies include brassica (white cabbage), pepper (kapia types), and fresh bean. The Institute co-ordinates brassica breeding studies that have been conducted as a part of "National F_1 Hybrid Project" funded by the State Planning Organization of Turkey. It is a joint project including Universities, research institutes and private seed companies. The F_1 Pepper Hybrid Project is also a part of the National F_1 Hybrid Project. The aim of the brassica and pepper project is to produce enhancement breeding for the private sector. Fresh bean breeding is underway to obtain resistance to anthracnose, a harmful disease in our region. Agronomic studies on fertilization via drip irrigation system (fertigation) have been conducted under cover or in the field.

FLORICULTURE

The key project is the National Tulip and Hyacinthus spp. Breeding Project funded by TUBITAK (The Scientific and Technological Research Council of Turkey). The project coordinated by KTAE was initiated in 2006. The major aims of the project are to collect tulip material in Anatolia, which is the gene center of the tulip, to make characterization and adaptation studies of the collected materials, and to ensure conservation of these materials in National Plant Gene Bank.

About the Author

Semiha Güler

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Global Crop Diversity Trust Receives Gates Foundation Funding

The Global Crop Diversity Trust has received the largest grant ever for the conservation of crop diversity! The *Bill and Melinda Gates Foundation* awarded $30 million to a partnership of the UN Foundation and the Trust for an unprecedented global initiative to rescue threatened, high-priority collections of crop diversity in developing countries and to support information systems to improve their conservation and availability. The grant will also enable developing countries and international agricultural research centres to place seed samples in the Svalbard Global Seed Vault for safety purposes.

Jane Toll and Luigi Guarino, internationally prominent figures in our field for more than two decades, have joined the Trust staff to lead this programme. $7.5 million of the grant was earmarked for the Trust's endowment, contingent on our finding a donor willing to match it. We are extremely grateful to Norway for volunteering to do so and in the process becoming the largest country donor to the Trust, taking their total given so far to over $15 million.

The *International Rice Research Institute (IRRI)* and the Trust have announced an historic partnership and financial arrangement that will ensure the permanent conservation and availability of the world's largest and most important rice collection. See www.croptrust.org for details.

A new Executive Board was formed. Dr. Margaret Catley-Carlson, current chair of the Global Water Partnership, former deputy head of UNICEF and former head of CIDA, Canada's development assistance agency, was elected to chair the board. Prof. Wangari Maathai, Nobel Peace Prize Laureate and head of Kenya's Greenbelt Movement, was elected vice-chair. Lewis Coleman, President of Dreamworks Animation, founding president of the Moore Foundation and former Vice Chairman and CFO of the Bank of America, was appointed to chair the Trust's Finance and Investment Committee. We bid a warm farewell to our wonderful interim board, headed by Ambassador Fernando Gerbasi, under whose leadership the Trust was firmly established.

Cary Fowler, Executive Secretary of the Global Crop Diversity Trust

World Food Prize Awarded to Philip Nelson, Food Scientist and Horticulturist

Dr. Philip E. Nelson

Philip Nelson, Professor of Food Science at Purdue University, was named winner of the 2007 World Food Prize for his pioneering work in aseptic storage of horticultural products. His invention of a specially designed valve has permitted the storage of horticultural products such as tomato pulp in huge tanks to await final processing to useful products. Aseptic bulk storage has been used in Brazil to transport orange juice in ships especially designed for transporting fresh juice to the US and Europe. Dr. Nelson has also created the techniques for storage of food products in a " bag-in-a box" system that allows food to be stored and shipped without spoilage. Nelson received his PhD degree while a member of the Department of Horticulture at Purdue in 1967. He was a staff member in the Department from 1961 to 1983 when he moved to the newly created Department of Food Science where he served for many years as Head of the Department. Phil grew up in Indiana where his family grew and processed tomatoes.

Jules Janick Receives Honorary Degree from Hebrew University of Jerusalem

An honorary doctorate was bestowed on Dr. Jules Janick at the Mount Scopus campus of the Hebrew University on June 3, 2007 in recognition for his *"exploration and development of new food crops whose pioneering insights and discoveries have had a significant impact on biotechnology, breeding and genetics, and medicinal drug development."* Other recipients of degrees in 2007 included German Chancellor Angela Merkel (received in March); Thomas L. Friedman, distinguished author and journalist; Professor Kanan Makiya, Iraqi academic; Professor Aaron Ciechanover, Nobel Laureate; Professor Ann M. Graybiel, Member, US National Academy of Science; Professor Sir Alan R. Fersht, Fellow, Royal Society; Professor Linda Nochlin, American Academy of Arts and Sciences; and Michael Dunkel, Governor of the Hebrew University and founder of the Orion Foundation. Janick's comments at a special ceremony honoring the awardees are included below.

Jules Janick receives symbol of the Hebrew University of Jerusalem from President Menachem Magidor and Rector Haim Rabinowitch at graduation ceremonies.

Israel, The Hebrew University of Jerusalem, and Horticultural Science

I sincerely thank President Menachem Magidor, Rector Haim Rabinowitch, the Board of Governors, and my sponsors Professors Eliezer Goldschmidt and Raphael Goren for this signal honor. I am pleased and proud to be recognized by the Hebrew University. There is no university, in any country, which has done more for horticulture and horticultural science. Your research has made the desert bloom. Your reputation is world renown. I give three examples of members of your faculty who have made a difference in world horticulture and influenced my life.

S.D Goldberg, senior lecturer in irrigation at the Faculty of Agriculture of the Hebrew University in Rehovot along with his student Menachem Shmueli created the modern concept of trickle irrigation – one of the most important horticultural innovation or production horticulture of the 20th century. With the emitters installed on the soil surface, the new system saved water, prevented salinization, and improved yields and performance. Trickle irrigation has found a place in all countries and all climates. It is an example of Israeli technology that has worked, been adopted, and made a difference all over the world.

Dr. Pinhas Speigel-Roy has made and continues to make significant advances in fruit breeding principally in citrus. I first met Dr. Speigel-Roy in 1970 when I attended the International Horticultural Congress in Tel Aviv when he was the head of the Congress and President of the International Society for Horticultural Science. I remember his call for horticulturists to improve quality, performance, and induce seedlessness, a call that has been amply fulfilled over the years in citrus, grape, watermelon, and loquat.

Professor Abraham Halevy, distinguished scientist of flowering, discoverer of new crops for floriculture, and Father of the Floriculture Industry of Israel was a friend of mine. He single handedly made Israel one of the most important producers of ornamentals in the world. He passed away last year but his work continues from his many students and colleagues. Abe we will never forget you.

Of course there is a long tradition of horticulture in Israel. The contribution of ancient Israel in horticulture is legion and the bible can be read as a horticultural text.

My beloved had a vineyard in a very fruitful hill. He digged it and cleared it of stones, and planted it with choice vines; he built a watchtower in the midst of it, and hewed out a wine vat in it; and he looked for it to yield grapes but it yielded wild grapes (Isaiah 5:1-2). There is a lot of horticulture and horticultural science in those verses and now wild grapes are even increasing in importance.

And thou shalt command the children of Israel that they bring thee pure beaten olive oil for the light, that a lamp may be set up to burn continually (Exodus 27:20). The light still burns.

And he shall be like a tree planted by the rivers of water, that yields its fruit in its season, and its leaf does not wither (Psalms 1:3). We still strive for drought resistance, now with molecular biology.

The righteous shall flourish like the palm tree... those that be planted in the house of the Lord shall flourish... They shall bring forth fruit in old age; they shall be fat and flourishing (Psalms 92:7-8). Israel is flourishing, but some of us are getting a bit fat.

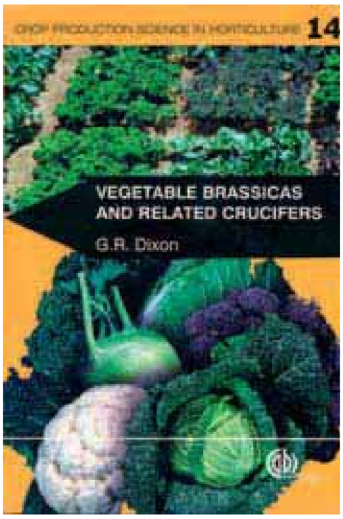
I close with words from Isaiah: *And they will hammer their swords into plowshares and their spears into pruning hooks. Nation will not lift up sword against nation. And never again will they learn war.* Let us look forward still to this prediction, for these words and this hope shall be in our hearts forever.

New Books, Websites

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

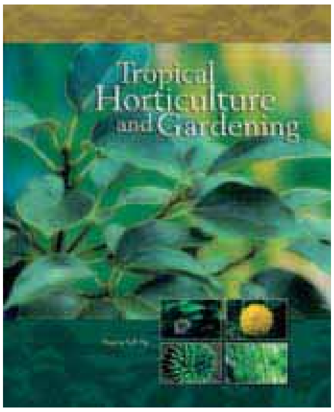
BOOK REVIEWS

Vegetable Brassicas and Related Crucifers. Geoffrey R. Dixon. 2006. Published by CAB International, Wallingford, Oxford, United Kingdom as No 14 in the series Crop Production Science in Horticulture. xii + 327p. ISBN 0-85199-395-8. £35.99.



The genus *Brassica* is truly a horticultural extravaganza producing such wide ranging crops including mustards, rapes, swedes, and cole vegetables; the latter include cabbage, kale, cauliflower, broccoli, turnip, kohlrabi, Brussels sprout (*B. oleraceae*, European group) along with caisin, Chinese cabbage, pak choi, mizuna, neep greens, taatsai, and vegetable turnip (*B. rapa* and allies, Oriental Group). Or as Geoff Dixon puts it, in a typical example of his unique prose style: *The quiet mundanity of rural cabbage yards belies the botanical miracles taking place within them by those arch-exponents of genotypic and phenotypic diversity and flexibility.* Dixon has done an exemplary job in making horticultural sense out of botanical chaos in this remarkable book, which is the 14th volume in CABI's Crop Production Science in Horticulture. The work is divided into eight chapters: 1. Origins and Diversity of *Brassica* and Its Relatives, 2. Breeding Genetics and Models, 3. Seed and Seedling Management, 4. Developmental Physiology, 5. Crop Agronomy, 6. Competitive Economy and Sustaining Production, 7. Pests and Pathogens, and 8. Postharvest Quality and Value. There are 29 pages of references! It would have been helpful if some colored photographs of the various types could have been included, even a one page insert would have helped, but readers will have to be satisfied with a colored cover. This book is clearly a product of Dr. Dixon's long career as a teacher and much of the book is a collection of his wisdom and experience. In the chapter of Pests and Pathogens he points out that the use of synthetic chemicals is diminishing in Europe and increasing elsewhere with the unfortunate consequences that agrochemical companies appear to have written off the development of new pesticides and he predicts that brassicas grown worldwide will be produced with limited use. Nevertheless, in the chapter there is constant reference to their use, although mentions of specific ones are deliberately omitted. Appropriate genuflection is made to the role of mouse cress, *Arabidopsis thaliana*, in unraveling the genetic complexity of brassicas as well as all plants. Students of the brassicas will find this book a required addition to their library.

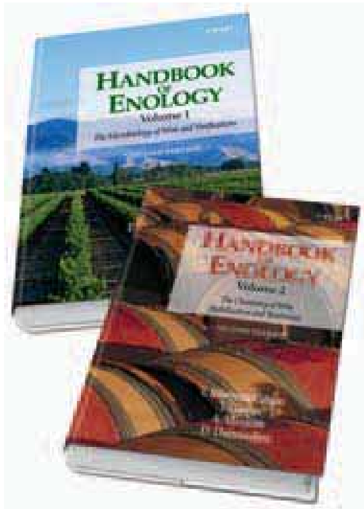
Tropical Horticulture and Gardening. Francis S.P. Ng. 2006. Clearwater Publications Sdn Bhd. Bandar Menjalara, Kuala Lumpur, Malaysia. 361p. ISBN 983-42954-0-5. $124.05. [150 SGD = 1.00 USD; 205 SGD = 1.00 euro.]



This is a stunningly beautiful book. Its 361 pages are crammed full of over 1000 colored photographs taken by the author, a Malaysian botanist and former employee of FAO in Rome. The book contains 9 chapters: 1. Plant Domestication, 2. The Knowledge System for Plants, 3. Plant Form and Habit, 4. Ferns and Fern Allies, 5. Gymnosperma, 6. Flowering Plants: Monocots, 7. Flowering Plants: Dicots, 8. Garden Design, and Plants, and 9. Tropical Environment. The bulk of the book are excursions; chapters 4 to 7 are arranged by species within families, all arranged alphabetically, with rather minimal but incisive descriptions that include the origins. The prose is well written and the love of plants as well as botanical and horticultural expertise of the author shines through. The chapter on Garden Design contains images of famous gardens throughout the world visited by the author. There are over 50 information boxes. This is a coffee table book on tropical plants and gardening that will appeal to temperate horticulturists who wish to get acquainted with the diverse garden flora of the tropics.

Above books were reviewed by Jules Janick, Purdue University, USA

Handbook of Enology. 2 volume set. 2nd Edition. P. Ribéreau-Gayon, Y. Glories, D. Dubourdieu, A. Maujean, B. Donèche and A. Lonvaud (eds.). 2006. John Wiley & Sons Ltd., UK. 928p. ISBN 978-0-470-01157-7 (hardcover). £150/€225. www.wiley.com/go/enology



Since the discovery of the role of yeast and alcoholic fermentation in transforming grape juice into wine in the 19th century, many scientific experiments in microbiology, biochemistry and chemistry have provided the basis for accurate definitions of the technological practices used in making different wines and continuous improvements in production conditions, as well as, consequently, the quality of the various types of wine.

In 1999, the first edition of the Handbook of Enology Volume 1 "The Microbiology of Wine and Vinification" and Volume 2 "The Chemistry of Wine: Stabilization and Treatments" provided an overview of scientific knowledge at that time and its application in techniques commonly used during the first stage in winemaking, from the grape harvest to the end of the fermentation processes, and during the second stage in winemaking, including stabilizing the wine, any treatments required, clarification, and aging processes in vats and barrels.

This new edition reaps the benefits of new developments based on the latest findings produced by extremely active scientific research in this field. There have been significant changes in the new version, including in-depth modifications to present updated knowledge as well as additional paragraphs covering entirely new topics. Altogether, the new edition has approximately 10% more pages than the previous version.

This new, updated handbook provides valuable information for winemakers, enology students, and, in general, for biochemistry and microbiology specialists interested in the scientific and technical issues involved in vinification.

NEW TITLES

Bainbridge, David A. 2007. A Guide for Desert and Dryland Restoration: New Hope for Arid Lands. Island Press, Washington, D.C., USA. 416p. 1-55963-969-5 (paperback). $50.00. www.islandpress.org

Bogers, Robert J., Craker, Lyle E. and Lange, Dagmar (eds.). 2006. Medicinal and Aromatic Plants - Agricultural, Commercial, Ecological, Legal, Pharmacological and Social Aspects. Wageningen UR Frontis Series, Volume 17. Published by Springer, Dordrecht, The Netherlands. xviii+309p. ISBN 978-1-4020-5448-8 (paperback). € 54.95. www.springer.com

Hodel, D.R. and Johnson, D.V. 2007. Imported and American Varieties of Dates (*Phoenix dactylifera*) in the United States. UC ANR Publication 3498, University of California, Oakland, CA, USA. 112p. ISBN 978-1-879906-78-5 (paperback). $25.00.

Yi Li and Yan Pei (eds.). 2007. Plant Biotechnology in Ornamental Horticulture. Food Products Press, The Haworth Press, Inc., New York. xix + 528p. ISBN 978-1-56022-150-0 (hardback). $90.00. ISBN 978-1-56022-151-7 (paperback). $55.00. www.haworthpress.com

Vidhyasekaran, P. 2007. Handbook of Molecular Technologies in Crop Disease Management. Food Products Press, The Haworth Press, Inc., New York. x + 462p. ISBN 978-1-56022-265-1 (hardback). $99.95. ISBN 978-1-56022-266-8 (paperback). $54.95. www.haworthpress.com

Wills, R.B.H., McGlasson, W.B., Graham, D. and Joyce, D.C. 2007. Postharvest: An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals. 5th edition. UNSW Press, Sydney, Australia and CABI Publishing, Wallingford, UK. 227p. ISBN 978 0 86840 980 1 and 978 1 84593 227 5 (paperback). AUD$44.95 and £29.50/$60.00/ € 47.00. www.unswpress.com.au and www.cabi.org

WEBSITES

www.ifava.org: International Fruit and Vegetable Alliance (IFAVA)

underutilized-species-blog.org: blog on underutilized species offered by the Global Facilitation Unit for Underutilized Species as a new communication tool for interested stakeholders

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

Lectures on Selected Topics on Genetics, Breeding and Evolution of Orphan Crops, 10-18 September 2007, Conference on New Approaches to Plant Breeding of Orphan Crops in Africa, 19-21 September 2007, Bern, Switzerland. Info: Dr. Zerihun Tadele or Prof. Dr. Cris Kuhlemeier, Institute of Plant Sciences, University of Bern, Altenbergrain 21, CH-3013 Bern, Switzerland, Phone: +41 31 631 49 54 or +41 31 631 49 13, Fax: +41 31 631 49 42, email: zerihun.tadele@ips.unibe.ch or cris.kuhlemeier@ips. unibe.ch, web: www.botany.unibe.ch/deve/orphancrops

Segundo Congreso Colombiano de Horticultura: Colombia Hortícola: Retos y Oportunidades, 12-14 September 2007, Bogotá, Colombia. Info: Phone: +57 (1) 3165000 ext 19036 or +57 (1) 8650218, email: soccolhort@gmail.com, web: www.soccolhort.com

30° Congreso Argentino de Horticultura, 1° Simposio Internacional sobre Cultivos Protegidos, 25-28 September 2007, La Plata, Argentina. Info: congresoasaholaplata@c3l.com.ar

53rd Annual Meeting of the Interamerican Society for Tropical Horticulture, 7-12 October 2007, Morelia, Mexico. Info: Universidad Autonoma Chapingo, Phone: 01 (595) 95 21 500 ext 6263 and 6388, Fax: 01 (595) 95 21 642, email: jamer2005@yahoo.com, r.moraaguilar@gmail.com, web: www.horticulturatropical2007.com

GROWTECH EURASIA 2007 - 7th International Horticulture, Agriculture, Floriculture and Technologies Fair, 6-9 December 2007, Antalya, Turkey. Info: NTSR Ekinciler Cd. Ertürk Sk. No:5 Kat: 3, 34810 Kavacik - Istanbul, Turkey, Phone: +90 216 425 63 00, Fax: +90 216 425 63 02, email: info@growtecheurasia.com, web: www.growtecheurasia.com

International Conference on Molecular Mapping & Marker Assisted Selection in Plants, 3-6 February 2008, Vienna, Austria. Info: Prof. Alisher Touraev, Max F. Perutz Laboratories, Department of Plant Molecular Biology, Vienna University, Dr. Bohrgasse 9, Vienna 1030, Austria, Phone: +431427754681, Fax: +43142779546, email: molmapping.pflanzenmolbio@univie.ac.at, web: www.univie.ac.at/molmapping/

Advanced Seminar on Design and Implementation of Drought Management Plans: Organization, Methodologies and Actions, 4-8 February 2008, Zaragoza, Spain. Info: Instituto Agronómico Mediterráneo de Zaragoza (IAMZ), Apartado 202, 50080 Zaragoza, Spain, Phone: +34 976 716000, Fax: +34 976 716001, email: iamz@iamz.ciheam.org, web: www.iamz.ciheam.org

Agricultural Film 2008, 18-20 February 2008, Barcelona, Spain. Info: Dr. Sally Humphreys, Applied Market Information Ltd, 45-47 Stokes Croft, Bristol, BS1 3QP, UK, Phone: +44(0) 117 924 9442, Fax: +44 (0) 117 311 1534, email: sh@amiplastics.com, web: http://www.amiplastics.com/ami/ AMIConference.asp?EventID=114

Advanced Course on Applied Statistical Methods in Plant Genomics, 18-29 February 2008, Zaragoza, Spain. Info: Mediterranean Agronomic Institute of Zaragoza / CIHEAM, Apartado 202, 50080 Zaragoza, Spain, Phone: 34 976 716000, Fax: 34 976 716001, email: iamz@iamz.ciheam.org, web: www.iamz.ciheam.org

5th International Crop Science Congress, April 2008, Jeju, Korea. Info: Prof. Ho-Jin Lee, Chairman, Organizing Committee of the 5th ICSC, College of Agriculture and Life Sciences, Seoul National University, Korea, Phone: +82-2-880-4559, Fax: +82-2-6000-1306, email: icsc2008@snu.ac.kr, web: www.cropscience2008.com

6th International Fructan Symposium, 27-31 July 2008, Sapporo, Japan. Info: Professor Shiomi Norio, email: n-shiomi@rakuno.ac.jp (President of the Symposium), or Professor Benkeblia Noureddine, email: ben-nour@rakuno.ac.jp (Secretariat), web: fructan2008.agr.hokudai.ac.jp/index.html

Third International Heather Conference, 31 July - 4 August 2008, Victoria, British Columbia, Canada. Info: Ella May T. Wulff, 2299 Wooded Knolls Drive, Philomath, Oregon, 97370, USA, email: ewulff@peak.org, web: www.northamericanheathersoc.org

11th International Citrus Congress (ICC2008), 26-30 October 2008, Wuhan, China. Info: Secretariat ICC2008, Huazhong Agricultural University, Wuhan 430070, Hubei Province, China, Phone: +86 27 87286965/87281181, Fax: +86 27 87280016/87286965, email: ICC2008@mail.hzau.edu.cn (general), ICCABSTRACT@mail.hzau.edu.cn (abstract submission), ICCFEE@mail.hzau.edu.cn (registration), web: ICC2008.hzau.edu.cn

Opportunities

Central Mexico Research Leader, Lake Chapala Area of Central Mexico

Long-Term Resident and Short-Term Agriculture and Agribusiness Consultants, Francophone W. Africa

Five Research Positions (Graduate or Postgraduate): Irrigation of Tree Crops and Vines, Valencia, Murcia, Lleida, Zaragoza and Cordoba, Spain

Director of Research, The Honduran Foundation for Agricultural Research, Honduras

Various Employment Opportunities, Aboureyhan Agriculture University College, University of Tehran, Iran

Cooperative Extension Specialist in Diseases of Vegetable and Ornamental Crops, University of California, Riverside, USA

For more information visit www.ishs.org/general

Symposia and Workshops

Section Medicinal and Aromatic Plants

Int'l Symposium on Medicinal and Nutraceutical Plants

The fundamental purpose of the symposium was to provide a forum for exchanging current research information on medicinal and nutraceutical plants that emphasized ethnobotany, bioprospecting, conservation, biotechnological research and improvement of medicinal and nutraceutical plants; medicinal plants-based industries focusing on challenges and opportunities; regional and global regulatory issues pertaining to the medicinal-plants industry; current trends in nutraceutical plants research, botanicals and women's health issues; the status of phytochemical and plant-based biomedical research; and medicinal plant grower perspectives. This symposium was designed to bring together professionals in medicinal / nutraceutical plants with researchers and scientists representing universities, governments, and private sector laboratories working in medicinal / nutraceutical (medicinal and aromatics, herbs, spices, and fruits and vegetables with health benefits) plants research in temperate, subtropical and tropical climates.

The participants in this 2007 International Symposium on Medicinal and Nutraceutical Plants organized by the Fort Valley State University, Fort Valley, Georgia, USA, under the auspices of the International Society for Horticultural Science, came from 23 different countries having advanced research programs as well as those developing countries around the globe with a wealth of diverse medicinal and nutraceutical plant species. They also represented 19 states in the United States of America. This 2007 ISHS symposium provided a comfortable and cozy setting for professionals and scientists with corresponding interests to exchange information and establish mutually rewarding collaborations. Sessions were devoted to ethnobotany and general information on current status and marketing and regulatory issues of bioactive plants, followed by research and production, grower perspectives, plant biotechnology and improvement techniques, regulatory issues, nutraceuticals, phytochemicals / bioactivity evaluation, and biomedicals collectively made this symposium really a unique one. This closely knit symposium explored progressive innovations recently made in medicinal and nutraceutical plants. Eight invited speakers, 43 oral presentations, and over a dozen posters enabled presenters to share their expert findings and experiences in their chosen mission pertinent to medicinal and nutraceutical plants.

Following the official opening of the symposium by the university administrators, invited speakers as well as volunteer speakers addressed programmatic topics over the course of the symposium during plenary sessions. Presenters presented their information during poster sessions in conjunction with the program agenda. There were adequate opportunities for interaction during question / answer sessions, topical discussions and networking functions. Participants enjoyed the Southern Hospitality through an organized welcome reception, daily meals and the symposium banquet on Thursday, 22 March 2007. Authors have been asked to submit full manuscripts for review and publication in *Acta Horticulturae* proceedings to be published post-conference by ISHS. Each individual participant paying the registration fee will receive a copy of the proceedings. Furthermore, the titles of the papers published, authors, abstracts and keywords will be available freely on the ISHS website. Full articles will be retrievable as PDF files at moderate prices (and to some extent free to ISHS members). Some fruitful research collaborations are expected to be established as a result of this conference. The sizeable and enthusiastic delegation from India was quite hopeful to organize the next such extensive conference around Delhi, India during 2009 or 2010.

Participants of the Symposium.

Anand K. Yadav

Contact

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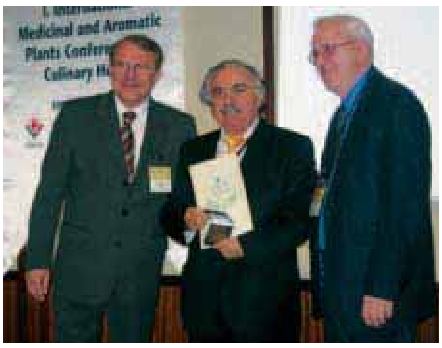
First Int'l Medicinal and Aromatic Plants Conference on Culinary Herbs

Participants of the Conference.

The natural flora of Turkey is rich and diverse with over 11,000 taxa, 35% of which is endemic. Antalya, the south eastern region of the country, is also called "Turkish Riviera", which is known primarily due to its famous resort places. Besides its picturesque scenery and remnants of historical sights, the region abounds in an extremely rich natural vegetation. In fact the flora of Antalya is known to be one of the richest among the provinces of Turkey, with 124 families, 642 genera and 2078 taxa. This vast botanical diversity has always attracted herb traders, essential oil producers and exporters from all over the world. Remarkably, most of the herbs are still collected from the wild state, so that the conservation of plant diversity and the sustainable production of quality herbs are imminent problems.

The First International Medicinal and Aromatic Plants Conference on Culinary Herbs was organized by the Faculty of Agriculture, Akdeniz University and ISHS in Antalya, Turkey between 29 April - 04 May 2007. The Conference was kindly supported by TUBITAK (The Scientific & Technological Research Council of Turkey) and attracted over 150 delegates from 29 different countries and 5 continents such as Algeria, Austria, Bosnia and Herzegovina, Brazil, Czech Republic, France, Germany, Greece, India, Iran, Israel, Italy, Jordan, Hungary, the Netherlands, Pakistan, Poland, Portugal, Romania, Saudi Arabia, Slovakia, South Africa, South Korea, Spain, Switzerland, Thailand, UK, Ukraine, and the USA. In the scientific program, 5 invited lectures, 40 oral presentations and 125 posters were presented. As a special accompanying feature of the Conference, an exhibition of artistic drawings of medicinal and aromatic plants prepared by a lecturer and students of the Faculty of Fine Arts, Akdeniz University, was exhibited in the conference hall. As another unique event, a workshop was organized with Prof. Dr. Lyle E. Craker giving a talk on the topic of "How to Prepare a Scientific Paper". This event proved to be especially attractive for young scientists and students.

Prof. A. Máthé (left) and Prof. L. Craker (right) handing over the ISHS certificate to co-conveners Prof. K. Turgut (top) and Prof. İ. Baktır (bottom).



The Conference atmosphere was wonderful with high quality of presentations, good discussions, a broad diversity of subjects, not to speak of the wonderful environment and excellent weather. Beyond the usual culinary usage of herbs, the presentations covered topics like the cultivation, biotechnology, biodiversity, essential oils, biological activities and analytical studies of medicinal and aromatic plants.

At the opening session, Prof. Dr. İbrahim Baktır, co-convener of the Conference and Prof. Dr. Mustafa Akaydın, Rector of the Akdeniz University welcomed the conference participants and distinguished guests. Subsequently, Prof. Dr. Akos Máthé (Chair of the ISHS Section Medicinal and Aromatic Plants) gave an overview of ISHS activities. He and former Chair Prof. Dr. Lyle Craker presented the ISHS medals to the conference conveners, Prof. Dr. Kenan Turgut and Prof. Dr. İbrahim Baktır.

The scientific program started with two invited papers: "American Taste for Herbs – Culinary Trends" by Prof. Dr. L.E. Craker and "Medicinal and Aromatic Plants Used as Culinary Herbs in

A group of participants in the Perge antique city. Participants found an opportunity to see well preserved historical remains and some wild aromatic plants in the antique city.

Turkey" presented by Prof. Dr. K.H. Can Başer. While Professor Craker talked about American consumption of culinary herbs during the past several decades, Professor Başer explained the richness and diversity of Turkish flora and most traded culinary herbs in Turkey, also in view of their original usage. On the second day of the scientific program, Prof. Dr. Chlodwig Franz, also an invited speaker, introduced the audience into the "Use of Herbs and Herbal Products in Veterinary Medicine and Animal Nutrition". He expressed roles of functional plant products in veterinary medicine and livestock production. Later, Prof. Dr. Eli Putievsky presented "Culinary Herbs in Israel from the Wild to the Market". He gave numerous examples on the collection and preservation of wild herbs from the Israeli flora as well as the identification of biodiversity for plant breeding. Prof. Akos Máthé, the fifth invited speaker, addressed and surveyed the quality assurance aspects of medicinal and aromatic plants. In his presentation entitled "Quo vadis? Quality Assurance System of Medicinal and Aromatic Plants?" he called attention to the large number and seemingly unharmonized international and national activities in formulating guidelines for both collection/production and manufacturing of medicinal plants.

Opening speech of Prof. Dr. Mustafa Akaydin, Rector of Akdeniz University.

The Conference was very fruitful since many scientists, students, sector representatives and growers from various nations found an opportunity to meet in such a good ambience. This meeting also provided an excellent opportunity to share information between world leading scientists and young scientists as well as students. Also, Turkish media and stakeholders realized the importance and potential usage of MAPs worlwide. Indeed, some national and local newspapers issued publications about the conference and reported about several presentations. Some commercial exhibitors put essential oils, fresh culinary herbs and organic fertilizers on display.

The half day excursion organized to complement the scientific program has also proved to be a highlight. Participants enjoyed the visit to Termessos National Park and Perge - Aspendos historical sites, in the province of Antalya. Termessos is a well known ancient city in the Taurus Mountains that is home to a large number of plant and animal species with many of them being protected, in the form of a National Park, where conference participants had the opportunity to discover many wild herbs and other plant species.

All in all, the First International MAP Conference on Culinary Herbs has proved to be a good initiative and congratulations are due to both conveners and their organizing team. The next conference is likely to take place either in France or the Korean Republic in three years time.

Kenan Turgut and Akos Máthé

Participants of the Conference walked through very rich natural flora and remains of the antique city of Termessos Natural Park. Indeed, they climbed up almost 1000 meters and enjoyed excellent scenery at the top of the hill.

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Sixth Int'l Symposium on New Floricultural Crops

Participants of the Symposium.

The VI International Symposium on New Floricultural Crops was held in Funchal, Madeira Island, Portugal, from 11 to 15 June 2007. The event was organized by the Regional Secretariat of Environment and Natural Resources (SRA) and the Centre for Macaronesian Studies from the University of Madeira (UMa). More than 122 participants from 28 countries attended the meeting. There were 38 oral presentations and 80 posters that covered the topics of native plants and genetic resources, sustainable use of biodiversity for floriculture and landscape, strategies for plant introduction, market trends and marketing, propagation and production, stress physiology and postharvest biology, technology and quality. The majority of the works presented was about propagation and production techniques of native plants that show potential for the ornamental industry. But quite a few interesting papers on strategies of plant introduction showed what has been created to obtain a new product that meets the consumer's demand and needs. There is also a lot of work being done in the native plants of each country, especially in their potential for the floricultural and landscaping sector. It was noticeable the awareness of the people for the importance of preserving the biodiversity, with local programs for biodiversity conservation and control of invasive species. The changes in the climate and in the resources' availability are triggering the search and use of native plants, more adapted to the local conditions and with less need of water and nutrients, and consequently with enormous advantages for the floricultural and landscaping industry, as well as for the biodiversity conservation.

The social part of the program included a wine tasting in the Wine Institute of Madeira, a one day tour to Laurisilva, the symposium dinner and a visit to the Botanical Garden of Madeira. The tour to Laurisilva allowed the participants to get to know better this small island, with an irregular terrain and split up by deep narrow valleys and gorges that show stunning mountain landscapes, Laurel forest and breathtaking coastlines. The Laurel forest (Laurisilva) with an area of 15 thousand hectares occupies a coastal strip from 300 to 1300 m above sea level and plays a crucial role in soil preservation and in capture and filtration of rainfall; this forest is considered a living relic and it was awarded the distinction of UNESCO World Natural Heritage in 1999. The visit also gave the opportunity to have an idea about the

Eleni Maloupa receiving an ISHS certificate for her service as the Chair of the Working Group on New Ornamentals during the last eight years.

Richard Criley and Eleni Maloupa handing over the ISHS medal and certificate to Maria Dragovic, convener of the symposium.

Field trip to Levada do Risco.

Margaret Johnston, Rina Kamenetsky and Mike Reid.

Ken Leonhardt and other participants.

Maria Dragovic, Fernando Tombolato, Eleni Maloupa and Gabriela Facciuto during the field trip.

other two main types of vegetation existing in the island and to appreciate the fantastic landscape and also the big number of endemic species, some of them easily watched and photographed!

In the Business meeting of the Working Group on New Ornamentals, Dr. Eleni Maloupa was recognized for her meritorious service as the Chair of the Working Group during the last eight years, and a new Chair and Vice-Chair were appointed for the next 4 years, Dr. Fernando Tombolato and MSc. Maria Dragovic, respectively. It was also decided that the next Symposium on New Floricultural Crops will be held in Buenos Aires, Argentina, in 2011, with Dr. Gabriela Facciuto as convener.

Maria João Oliveira Dragovic

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Section Pome and Stone Fruits

Tenth Int'l Pear Symposium

Cristina Moniz Oliveira and Armando Torres Paulo.

The Xth International Pear Symposium organised by the Portuguese Pear Growers Association (ANP) and the Portuguese Association for Horticulture (APH) under the auspices of the ISHS was held in Peniche, Portugal on 22-26 May 2007. Overall 172 titles were offered, 57 oral presentations and 115 posters were included in the program that comprised three days of oral and poster sessions and one day visit to a packinghouse and pear orchards. Over 212 delegates from 31 countries attended making the symposium a truly international meeting.

After an official welcome by Armando Torres Paulo (Convener of this Symposium), Manuel Soares (President of APH), Prof. Theron (Chair ISHS Working Group on European and Asian Pears) and Dr. Webster (Chair ISHS Section Pome and Stone Fruits), three keynote speakers, opened the Symposium. Prof. Sansavini presented an overview of intensive pear orchard management, focusing on the main aspects where research is needed. Prof. Karen Theron followed with a talk on the physiology of girdling, referring in particular to the aspects related to flower induction. Dr. Becker from Bayer CropScience, the Emeritus sponsor of the Symposium, dealt with how food chain partnership can lead to the implementation of integrated crop solutions. The world wide pear industry in New Zealand and Australia, Asia, South and North America, South Africa and Europe was addressed by invited speakers.

SCIENTIFIC PROGRAMME

Fruit Set Control

Presentations focused on the effect of plant growth regulators and management strategies to control vigour and fruit set. The mechanisms underlying the Gametophytic Self Incompatibility (GSI) system and the use of *Pyrus* genotypes as pollinators were also addressed in detail.

Crop Physiology and Ecophysiology

Dr. Grapadelli from the University of Bologna presented results of the effect of two rootstocks on the photosynthetic efficiency and photo-oxidative stresses of pear scions demonstrating the influence of rootstocks on leaf and whole canopy photosynthesis. The subsequent oral and poster presentations focused on the agronomical performance of pear cultivars. An important topic was the effect of climate changes on pear production with strong emphasis on the impact on colour development, accomplishment of chilling requirements and maturation date.

Molecular Biology and Biotechnology

A study of the *Pyrus* genus through chloroplast DNA, as well as several contributions of *Pyrus* fingerprinting added more knowledge to phylogenetic relations within *Pyrus*. Three pioneering studies namely, characterisation of expression, and cloning of ripening-related MADS box genes in pear fruit, identification of genes coding for NH_4^+ transporters in pear/quince combination and identification of genes related to anthocyanin production in fruit were presented. Dr. Lebedev from the Institute of Bioorganic Chemistry addressed the intron-mediated enhancement of foreign gene expression and its stability in transgenic pear rootstocks. Identification of *S*-genotypes and characterisation of genes involved in the GSI were also important contributions.

Cultivars Breeding and Evaluation

Breeding aims and crossing types from breeding programmes from IRTA-HortResearch,

Participants of the Symposium.

Field Trip: 'Rocha' pear posters face to face with participants.

HortResearch, and from INRA were described. Potential alternative cultivars for the U.S. West Coast are being evaluated with an emphasis on consumer preferences.

Nutrition and Fertilization

The efficiency of applied nitrogen and reduction of its environmental impact can be achieved through applications of amino acids, nitrification inhibitor or boron. The contribution of senescent leaves to nitrogen cycling in orchards was also addressed. The need of more effective diagnosis tools to evaluate tree nutrition was stressed during the plenary discussion.

Propagation, Rootstock Breeding and Evaluation

The evaluation of rootstock selections for high density pear orchards in several regions was described. "Does rootstock affect fruit colour independent of light exposure?" and "What cause(s) the effect?" were questions addressed by Dr. Steyn from Stellenbosh University. 'Forelle' on quince rootstocks seem to have a higher innate ability to produce red fruit compared to BP rootstock and this could relate to vigour and maturity.

Orchard Design, Training and Pruning Systems

Choosing the right training/rootstock combination for high density plantings is the key factor for economic success. However low-input systems in certain circumstances can be an adequate alternative to HDS systems. A new training system Bibaum® is being studied and provisional data indicates that yield and quality is high and with the advantage of reduced pruning hours.

Scientific Committee at work.

Plant Protection and Biology of Pests and Diseases

Leaf shredding or removal or plastic covers are more effective than chemical or biological methods to control *Stemphylium vesicarium*. Interesting results were obtained in Belgium with post floral treatments with fosetyl-aluminium to control *Alternaria alternata*, one of the causes of dead flower buds of pear. Concerning codling moth, aerosol pheromone emitters appear promising as stand-alone (with insecticide supplements) or as low cost supplement. Future pear pest management will rely on pheromone mating disruption combined with limited use of selective reduced risk insecticides (e.g. spinetoram).

Postharvest Biology and Technology

Why don't pear fruit ripen on the tree? Dr. Murayama from Yamagata University showed us an ingenious experiment where ethylene produced by the fruit itself might induce fruit drop before ripening on the tree. Controlling scald with alternatives other than antioxidants can be promising. Chlorophyll fluorescence imaging and other non-destructive methods to predict physiological disorders are currently under investigation. Consumer evaluation and willingness to pay are hot topics to increase pear consumption.

FIELD TRIP

Despite the poor weather conditions in the afternoon the field trip was very well organised. Well-informed technicians presented exhibits and guided participants around the tour. A field trip booklet with all the information displayed at field stops was previously delivered. During the tour participants had the opportunity to meet some members of the "Rocha Pear Brotherhood" and to taste the most "probably best pear in the world". Lunch was a good opportunity to relax and take a photo of the group.

Every night there was a dinner with a theme. Particularly enjoyable and highly successful were the "Wine" and "Baroque Music" dinners.

During the business meeting Prof. Karen Theron showed the ISHS official web page http://wwwpearworkgroup.org/ and encouraged participants to deliver information.

In conclusion, feedback received is very encouraging stressing the friendly atmosphere throughout the meeting, the high scientific level and the excellent organisation of the event.

If you want to know more about the Pear Symposium: http://wwwpears2007.com/

Cristina Moniz Oliveira and Armando Torres Paulo

Rocha Pear Brotherhood with participants.

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First Int'l Symposium on Breadfruit Research and Development

Participants of the Symposium. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

The First International Symposium on Breadfruit Research and Development took place in Nadi, Fiji, 16-19 April 2007. Participants came from Africa, the Seychelles, the Caribbean, Sri Lanka, and the Pacific and Australia, and included researchers from national, regional, and international organizations, universities, government ministries, NGOs, the private sector, as well as Secretariat of the Pacific Community (SPC) staff.

Five major themes provided the focus for the Symposium, namely: 1) Breadfruit in Society, 2) Diversity and Conservation, 3) Germplasm Exchange and Crop Improvement, 4) Production and Production Constraints, and 5) Product Development and Marketing.

The Symposium consisted of 1.5 days of plenary sessions where papers were presented by the majority of participants. Aleki Sisifa, Director, SPC Land Resources Division, opened the proceedings with an excellent overview of breadfruit in the Pacific, highlighting how it has developed into an export commodity for some countries in the Pacific, yet at the same time remains an essential food security crop, especially for atoll countries. The keynote address was given by Dr. Diane Ragone, Director of the Breadfruit Institute, National Tropical Botanical Garden (NTBG), Hawaii, whose enthusiasm for, and commitment to breadfruit is apparent to all who meet her. Her efforts have ensured that more than 120 varieties from the Pacific are conserved in the world's largest collection of breadfruit (over 200 accessions) at the NTBG.

The plenary sessions were followed by Working Group sessions, with each Group addressing one theme of the Symposium, identifying possible projects and prioritizing recommendations. The Focus Session was devoted to developing a global strategy for the conservation and utilization of breadfruit and the sharing of breadfruit germplasm using the multilateral system on which the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA) is based.

Opening ceremony with traditional Fijian 'salusalu'. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

A field trip was organized by Sant Kumar, General Manager of the Nature's Way (Cooperative) Fiji Ltd. Participants were impressed by both the Legalega Research Station where staff are conducting research on different propagation techniques and the processing facility where fresh breadfruit is prepared for export to New Zealand. An unexpected delight was the lunch provided on the field trip where there were nine different dishes - all prepared with breadfruit!

The importance of sharing of knowledge and information about breadfruit was a cross-cutting issue with all the themes. The Symposium showed that despite breadfruit being an underutilized crop, there is a significant volume of knowledge "out there". Participants from the Caribbean were interested in the agronomic practices of the Pacific. Similarly there was interest in presentations from the Caribbean region, which described the approach they took to improving the status of breadfruit in the community. Documentation of agronomic practices would also assist other regions/countries to determine where breadfruit could be grown, especially areas where there are food security issues, such as in parts of Africa.

Judy Rouse-Miller and Dr. Laura-Roberts-Nkrumah - University of the West Indies, Trinidad - and Dr. Mary Taylor, SPC (left to right), examine an air-layered breadfruit. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

Field visit to research station with dwarf breadfruit trees. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

Adelino Lorens, Federated States of Micronesia, admires an easy-to-harvest breadfruit. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

Dr. Diane Ragone with Mr. Dickson Gamedoagbao, Ghana, and Dr. Taiwo Omobuwajo, Nigeria. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

Concern was expressed at the loss of local knowledge on breadfruit in some parts of the world. Local knowledge is important because it can guide appropriate conservation strategies, form the basis of research and aid the development of acceptable products. It can also support promotional efforts. The group agreed that there is a need to collect and document breadfruit knowledge, encompassing all aspects of breadfruit in society, from traditional beliefs to agronomic practices. Such documentation could be used for both product development and awareness campaigns.

One common issue facing development and acceptance of breadfruit was the "social stigma" associated with traditional crops, including breadfruit. Imported foods compete strongly with traditional foods, and the aggressive marketing associated with many imported foods has a significant impact on the behaviour of young people. This whole situation is exacerbated by evidence that indicates that the increase in lifestyle diseases observed in many African, Caribbean and Pacific (ACP) countries is associated with the move away from a diet of traditional foods to one where imported foods dominate. The participants strongly agreed that this trend must be reversed. Developing "convenience" breadfruit products and raising breadfruit's visibility as a culturally significant and a healthy, nutritional food through school curricula, communication strategies and public awareness were suggested as a way forward.

There were, in all, some 36 recommendations from the Symposium but the major recommendation targeted the collection at NTBG. The Symposium participants acknowledged that this collection and the work at NTBG make a significant contribution globally to breadfruit research and development and that the security of this collection should be ensured "in perpetuity". They therefore recommended that the NTBG collection be part of the multilateral system (MLS) of the International Treaty as set out in Article 15, to facilitate the collection's continued conservation and use throughout the world.

Symposium field trip features delicious array of breadfruit dishes. Photograph by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

This Symposium was the result of collaboration between international organizations including the SPC Land Resources Division, the Breadfruit Institute of the National Tropical Botanical Garden (NTBG), the German Technical Cooperation (GTZ), the International Centre for Underutilized Crops (ICUC), the Global Facilitation Unit for Underutilized species, and the Global Crop Diversity Trust. The proceedings for this Symposium will be published by the International Society for Horticultural Science (ISHS) as part of the standing series of *Acta Horticulturae*.

Mary Taylor and Diane Ragone

Dr. Mary Taylor, meeting organizer, SPC (left), Mr. Aleki Sisifa, Director, SPC Land Resources Division (center), and Dr. John Woodend, CTA (right), at the opening ceremony. Photographs by courtesy of Jim Wiseman, Breadfruit Institute, NTBG.

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New ISHS Members

ISHS is pleased to welcome the following new members:

NEW INSTITUTIONAL MEMBERS:

Australia: Globalhort Research

India: ICRISAT

Netherlands: World Allium Association, Floraculture International bv

United Kingdom: Warwickshire College

USA: Longwood Gardens, Inc.

NEW INDIVIDUAL MEMBERS:

Armenia: Dr. Aleksandr Kalantaryan; **Australia:** Mr. Stephen Ansermino, Ms. Robyn Baker, Mr. Les Baxter, Mr. Michael Biggs, Mr. Lawrence Bonney, Cecil Camilleri, Mr. Fernando Cely, Mr. David Copping, Mr. Jon Durham, Ms. Remie Fujiwara, Dr. Dion Harrison, Mr. Gordon Hopps, Mr. Eric Kok, Dr. Don Loch, Dr. Omar Lum, Mr. Protais Muhirwa, Isabella Olszewski, Mr. David Pearce, Dr. Kerry Porter, Dr. Kevin Seaton, Mr. Duane Storey, Mr. William Swann, Mr. Malcolm Taylor; **Belgium:** Prof. Dr. Ahmed Igout, Mr. Jos Mertens, Mr. Guy van Daele; **Brazil:** Mr. Frederico Denardi, Dr. Gilmar Henz, Mr. Alexsandro Marques, Prof. Dr. Silvia Nietsche, Dr. Albericio Pereira de Andrade; **Cameroon:** Dr. Bella Manga; **Canada:** Diana Astolfi-Jog, Linda Centomo, Mr. Helmut Leili, Ms. Kit Leung, Dr. Wendy McFadden-Smith, Dr. Rémi Naasz, Mr. Jasvir Sandhu, Mr. Sarab Sandhu, Ms. Cheryl Trueman, Mr. Jacob Vyn; **Chile:** Mr. Felipe Aburto, Mr. Matias Avendaño, Mr. Giovanni Castagna, Mr. German Castillo, Maria Gabriela Chahin Anania, Ms. Cintia Gayoso Neira, Assist. 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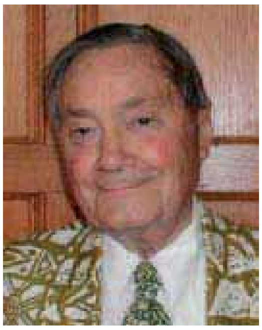
Fritz, Dr. Don Diego Guerena, Mr. Theodore Gunn, William Hammer, Jerry Hanson, Muff C. Harner, Ms. Diane Haskins, Mr. Kevin Healy, Matthew Heil, Christopher Hendrickson, Mr. Joseph Hirzel, Mr. Brian Hogan, Dr. Ray Hoobler, Mr. Raleigh Horne, Mr. Nickols Huang, Scott A. Inman, Mr. Robert Jacquet, Mr. Brian Jernigan, Robert Jetton, Dr. Joseph Kepiro, Mr. Paul Kingsley, Bruce Klewer, Robert R. Krueger, Assist. Prof. Julia Kuzovkina, Zachary Larsonrabin, Dr. John Lawyer, Ms. Rachel Layman, Aaron Layton, Valley Library, Dr. Litang Lu, Dr. William Lulves, Ms. Angela Madeiras, John B. Masiunas, Mr. James McCain, Dr. Rebecca McGee, Conor McGibboney, Mr. Wayner Montero Carmona, Michael Murphy, Mr. Neil Nagata, Seenivasan Natarajan, Ms. Katherine Oshana, Andrea Pabon, Brian Pearson, Mr. Donovan Pullen, Dr. Susan Raftery, Dr. Russell Rasmussen, Mr. Richard Rice, Mr. Donald Robinson, Ms. Rominica Romero, Caius Rommens, Mr. Mikael Rovala, Mr. Andrew Roy, Assist. Prof. Paolo Sabbatini, Ms. Megan Sadusky, Janice Schroer, Goutam Shahani, Dr. Peter Shaw, Assist. Prof. Tara Sirvent, Dave Small, Daniel Sortwell, Mr. Nicholas Stephens, Janice Stone, Linda Sturtevant, Mr. Wally Thompson, Mr. Robert Threlfall, Brian Trader, Richard Veilleux, Mr. Robert Vennes, Dr. Meenu Vikram, Edgar Vinson, David Walfish, William Watson, Annette L. Wszelaki, Makiko Yamashita, Francis Zee; **Venezuela:** Mr. German Russi; **Vietnam:** Ms. Tan Loc Nguyen Thi; **Zimbabwe:** Mr. Kevin Ndemera.

In Memoriam

JOHN G. SEELEY



John G. Seeley

John G. Seeley, Professor Emeritus of Floricultural Science at Cornell University, passed away May 9 in Ithaca, NY, USA at age 92.

John was a native of New Jersey, and very proud of his B.S. and M.S. degrees from Rutgers University. He received the Ph.D. from Cornell in 1948 under the guidance of Kenneth Post. He served on the faculty of the Pennsylvania State University for ca. 7 years, and returned to Ithaca in 1956 as Head of the Department of Floriculture and Ornamental Horticulture. As Head, he presided over an active and progressive department, and was instrumental in securing the new Kenneth Post Laboratory and Greenhouse facilities in the mid-1960s. Upon stepping down from the Head position in 1970, he assumed professorial duties in floriculture teaching, research and extension. He was highly active in both ASHS and ISHS, serving as ASHS president 1982-1983. A complete listing of his career accomplishments may be found in *Chronica Horticulturae* 23(1), June 1983.

As Department Head, he was a "benevolent dictator" and remains known as a mentor, protector of young faculty, and strong advocate for his department. He was a well-known participant in international horticultural science meetings, and provided significant leadership to the Section Ornamental Plants in the 1960s to mid-1980s. He was instrumental in opening the eyes of many young students to the international world of floriculture.

In his research career, John actually was major professor for a relatively small number of floriculture students, but his positive professional influence was felt by a great many more (including the author and, interestingly, his father, for whom John ultimately served as the Ph.D. thesis advisor in the late 1950s).

John was a popular teacher, and is remembered for his weakness for ice cream at the end of long, hot greenhouse tours in the spring semester. He was a perfectionist in terms of writing, formatting, spelling and style, as anyone who suffered his editing can attest! Many graduate students will admit that his class notes, and their extensive bibliographies of "older" literature, formed the basis of their floriculture crop courses in the 1980s and 1990s. Many also benefited from his "basement cleaning" when parcels containing classic, out-of-print floricultural papers, bulletins or books arrived in the mail.

Since 1970, John had the great pleasure of serving as a Trustee (later President) of the Fred C. Gloeckner Foundation, a significant source of competitive floriculture research funding in the United States. He was a strong advocate for young faculty, and many current U.S. floriculture professors (including the author) will state that funding from the Gloeckner Foundation was instrumental in getting their fledgling research programs started, recruiting graduate students, and obtaining tenure.

Upon his Cornell retirement in 1983, his colleagues decided to honor his career with the establishment of the Seeley Conference, the annual "think tank" for floriculture. John was very pleased with the conference and its intellectual approach to important subjects confronting floriculture. The 22nd annual Seeley Conference was just concluded at Cornell, where the ca. 100 industry leaders explored ways to reduce the profit squeeze in the industry. His seat was empty, and his presence sorely missed.

William B. Miller, Cornell University, USA

Calendar of ISHS Events

For updates and more logon to www.ishs.org/calendar. Do always mention your ISHS membership number or attach copy of your ISHS membership card when registering. A reduced ISHS members registration fee applies.

YEAR 2007

- September 10-14, 2007, Greenway Woods, White River (South Africa): **International Symposium on Recent Advances in Banana Crop Protection for Sustainable Production and Improved Livelihoods.** Info: Dr. Altus Viljoen, Department of Plant Pathology, University of Stellenbosch, Private Bag X1, Matieland 7600, South Africa. Phone: (27)21-8084797, Fax: (27)21-8084956, E-mail: altus@sun.ac.za or Dr. Inge Van den Bergh, Bioversity International, 1990 Boulevard de la Lironde, Parc Scientifique Agropolis II, 34397 Montpellier, France. Phone: (33)4-67611302, Fax: (33)4-67610334 Web: http://www.promusa.org.

- September 12-15, 2007, Faro (Portugal): **III International Symposium on Acclimatization and Establishment of Micropropagated Plants.** Info: Prof. Dr. Anabela Romano, Universidade do Algarve, Campus de Gambelas, Faro 8000-117, Portugal. Phone: (351)289800910, Fax: (351)289818419, E-mail: aromano@ualg.pt Web: http://www.ualg.pt/aemp2007.

- NEW September 16-20, 2007, Zaragoza (Spain): **XII Eucarpia Symposium on Fruit Breeding and Genetics.** Info: Dr. Rafael Socias I Company, Unidad de Fruticultura, Apartado 727, 50080 Zaragoza, Spain. Phone: (34)976716313, Fax: (34)976716335, E-mail: rsocias@aragon.es

- September 16-20, 2007, Aas (Norway): **International Symposium on Genetic Modification - Challenges and Opportunities for Horticulture in the World.** Info: Dr. Trine Hvoslef-Eide, Norwegian University of Life Sciences, UMB, Boks 5003, 1432 Aas, Norway. Phone: (47) 64 96 50 04, Fax: (47) 64 96 60 24, E-mail: trine.hvoslef-eide@umb.no Web: http://www.gmo2007.no.

- September 20-21, 2007, Keszthely (Hungary): **IV International Phylloxera Symposium.** Info: Dr. László Kocsis, Deák F. u. 16, 8360 Keszthely, Hungary. Phone: (36)83545058, Fax: (36)83545058, E-mail: kocsis-l@georgikon.hu Web: http://www.georgikon.hu/phylox.

- September 23-27, 2007, Hanoi (Vietnam): **International Symposium Improving the Performance of Supply Chains in the Transitional Economies - Responding to the Demands of Integrated Value Chains.** Info: 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.muresk.curtin.edu.au/conference/ishsvn.

- October 4-6, 2007, Naples (Italy): **International Conference on Sustainable Greenhouse Systems - GREENSYS2007.** Info: Prof. Stefania De Pascale, University of Naples, Department of Agricultural Eng. & Agronomy, Via Universita 100, 80055 Portici (Naples), Italy. Phone: (39)0812539127, Fax: (39)0817755129, E-mail: depascal@unina.it Web: http://www.greensys2007.com.

- October 8-12, 2007, Kusadasi (Turkey): **II International Symposium on Tomato Diseases.** Info: Prof. Hikmet Saygili, Ege University, Ziraat Fakultesi, Bitki Koruma Bolumu, 35100 Bornova Izmir, Turkey. Phone: (90)2323886857, Fax: (90)2323881864, E-mail: hikmet.saygili@ege.edu.tr Web: http://www.2istd.ege.edu.tr.

- October 9-13, 2007, Houston, TX (United States of America): **II International Symposium on Human Health Effects of Fruits and Vegetables.** Info: Dr. Bhimanagouda Patil, Texas A&M University, Department of Horticulture, 1500 Research Parkway Ste A120, College Station, TX 77845, United States of America. Phone: (1)9798624521, Fax: (1)9798624522, E-mail: b-patil@tamu.edu Web: http://favhealth2007.tamu.edu.

- October 15-19, 2007, Wageningen (Netherlands): **V International Symposium on Taxonomy of Cultivated Plants.** Info: Dr. Ronald van den Berg, Wageningen UR, Bulding No. 351, Gen. Foulkesweg 37, 6703 BL Wageningen, Netherlands. E-mail: ronald.vandenberg@wur.nl Web: http://www.istcp2007.wur.nl.

- October 21-25, 2007, Santa Catarina (Brazil): **VIII International Symposium on Temperate Zone Fruits in the Tropics and Subtropics.** Info: Dr. Gabriel Berenhauser Leite, EPAGRI, Estação Experimental de Caçador, C.P. 591 Caçador SC, 89500-000, Brazil. E-mail: gabriel@epagri.rct-sc.br or Dr. Flavio Herter, EMBRAPA/CPACT, C. Postal 403, 96001-970 Pelotas, Brazil. Phone: (55)532758100, Fax: (55)532758220, E-mail: herter@cpact.embrapa.br Web: http://www.cpact.embrapa.br/eventos/2007/VIIITZFTS/.

- October 22-26, 2007, João Pessoa - Paraíba (Brazil): **VI International Congress on Cactus Pear and Cochineal and the VI General Meeting of FAO-CACTUSNET.** Info: Juliana Rossignol, FAO CACTUSNET, Cactus Pear Symposium Secretariat, João Pessoa, Paraiba, Brazil. Phone: (55)8332225144, E-mail: congressopalma@senarpb.com.br or Dr. Albericio Pereira de Andrade, R. Nilton Etilac Leal, 1189, Alto Branco, CEP 58102-485, Campina Grande, PB, Brazil. Web: http://www.cactus-pearcongress2007.com.

- October 23-25, 2007, Bursa (Turkey): **International Workshop on Chestnut Management in Mediterranean Countries: Problems and Prospects.** Info: Prof. Dr. Arif Soylu, Uludag University, Faculty of Agriculture, Department of Horticulture, Görükle, 16059 Bursa, Turkey. Phone: (90) 224- 442 89 70, Fax: (90) 224 442 90 98, E-mail: arifsoylu@yahoo.com Web: http://www.chestnut2007turkey.org.

- October 29-31, 2007, Dronten (Netherlands): **V International Symposium on Edible Alliaceae.** Info: World Allium Association, P.O. Box 822, 3700 AV Zeist, Netherlands. Phone: (31)306933489, Fax: (31)306917394, E-mail: phoftijzer@europoint.eu or Mr. Johan H.J. Haarhuis, Rooseveldlaan 20, 3844 AJ Harderwijk, Netherlands. Web: http://www.worldalliumassociation.com.

- NEW November 11-13, 2007, Ravensburg (Germany): **COST-ISHS Workshop on Ripening Regulation and Postharvest Fruit Quality.** Info: Mr. Roy McCormick, Köpfchenstrasse 12, 57072 Siegen, Germany. Phone: (49)2712501651, E-mail: roy.fionn@t-online.de or Dr. Josef Streif, Institut Fuer Obstbau, Bavendorf, 88213 Ravensburg, Germany. Phone: (49)7517903325, Fax: (49)7517903322

- NEW November 15-17, 2007, Plovdiv (Bulgaria): **I Balkan Symposium on Fruit Growing.** Info: Dr. Argir Zhivondov, Director, Fruit Growing Institute, 12 Ostromila Street, 4004 Plovdiv, Bulgaria. Phone: (359)32692349, Fax: (359)32670808, E-mail: instov@infotel.bg E-mail symposium: fruit_symposium@abv.bg.

- November 18-23, 2007, João Pessoa, Paraiba (Brazil): **VI International Pineapple Symposium.** Info: Dr. Domingo Haroldo Reinhardt, Embrapa Cassava & Tropical Fruits, Caixa Postal 7, 44380-000 Cruz das Almas, BA, Brazil. Phone: (55) 75 3621 8002, Fax: (55) 75 3621 8097, E-mail: dharoldo@cnpmf.embrapa.br Web: http://www.ipsbrasil2007.com.br.

- December 3-6, 2007, Bangkok (Thailand): **International Conference on Quality Management of Ornamentals (QMSCO 2007).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University, Division of Postharvest Technology, 91 Prachautit, 10140 Thungkru, Bangkok, Thailand. Phone: (66)2 470 9796, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th Web: http://www.kmutt.ac.th/QMSCO2007.

- December 3-6, 2007, Bangkok (Thailand): **Europe-Asia Symposium on Quality Management in Postharvest Systems (EURASIA2007).** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University, Division of Postharvest Technology, 91 Prachautit, 10140 Thungkru, Bangkok, Thailand. Phone: (66)2 470 9796, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th Web: http://www.kmutt.ac.th/EURASIA2007.

YEAR 2008

- January 6-9, 2008, Orlando, FL (United States of America): **International Symposium Application of Precision Agriculture for Fruits and Vegetables.** Info: Dr. Reza Ehsani, University of Florida, Citrus Research and Education Ctr., 700 Experiment Station Rd., Lake Alfred, FL 33850, United States of America. Phone: (1)8639561151 ext 1228, Fax: (1)8639564631, E-mail: ehsani@ufl.edu or Prof. L. Gene Albrigo, 7 Winterset Drive, Winter Haven, FL 33884, United States of America. Phone: (1)8633244942, Fax: (1)8639564631 Web: http://www.precisionag2008.com.

- NEW February 3-6, 2008, Chiang Mai (Thailand): **International Symposium on The Socio-Economic Impact of Modern Vegetable Production Technology in Tropical Asia.** Info: 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.muresk.curtin.edu.au/conference/ishsvtc.

- February 17-20, 2008, Wien (Austria): **I International Symposium on Horticulture in Europe.** Info: Prof. Dr. Gerhard Bedlan, Austrian Agency for Health & Foodsafety, Institute for Plant Health, Spargelfeldstrasse 191, 1226 Wien, Austria. Phone: (43)5055533330, Fax: (43)5055533303, E-mail: gerhard.bedlan@ages.at Web: http://www.she2008.eu.

- NEW March 3-7, 2008, Huelva (Spain): **VI International Strawberry Symposium.** Info: Dr. José Lopez Medina, Dpto. Ciencias Agroforestales, Escuela Politécnica Superior, Campus La Rabida, Univ.Huelva, 21819 Palos de la Frontera - Huelva, Spain. Phone: (34)959217522, Fax: (34)959350311, E-mail: medina@uhu.es Web: http://www.iss2008spain.com.

- March 3-7, 2008, Arusha (Tanzania): **I International Symposium on Underutilized Plant Species.** Info: Dr. Hannah Jaenicke, Director, International Centre for Underutilised Crops, PO Box 2075, Colombo, Sri Lanka. Phone: (94)112787404ext3307, Fax: (94)112786854, E-mail: h.jaenicke@cgiar.org or Dr. Irmgard Hoeschle-Zeledon, GFU Underutilized Species, Via dei Tre Denari, 472/a, 00057 Maccarese, Rome, Italy. Phone: (39)06-6118-292, Fax: (39)06-61979661 Web: http://www.icuc-iwmi.org/Symposium2008/.

- March 16-19, 2008, Palermo (Italy): **IX International Symposium on Plum and Prune Genetics, Breeding and Pomology.** Info: Prof. Dr. Francesco Sottile, Dipartimento di Colture Arboree, Viale delle Scienze 11, 90128 Palermo, Italy. Phone: (39)0917049000, Fax: (39)0917049025, E-mail: fsottile@unipa.it Web: http://www.unipa.it/plum2008/.

- NEW April 3-6, 2008, Beijing (China): **III International Late Blight Conference.** Info: Mr. Greg Forbes, Centro Internacional de la Papa (CIP), Apartado 1558, Lima 12, Peru. Phone: (51)13496017, Fax: (51)13175326, E-mail: g.forbes@cgiar.org Web: http://research.cip.cgiar.org/gilb/registrationgilb/newgilb.php.

- April 6-11, 2008, Antalya (Turkey): **International Symposium on Strategies Towards Sustainability of Protected Cultivation in Mild Winter Climate.** Info: Prof. Dr. Yüksel Tüzel, Ege University, Agriculture Faculty, Department of Horticulture, 35100 Bornova Izmir, Turkey. Phone: (90)2323880110ext1398, Fax: (90)2323881865, E-mail: yuksel.tuzel@ege.edu.tr Web: http://www.protectedcultivation2008.com.

- April 20-24, 2008, Haarlem (Netherlands): **International Symposium of Virus Diseases in Ornamentals.** Info: Dr. Ellis Meekes, Sotaweg 25, PO Box 40, 2371 GA Roelofarendsveen, Netherlands. Phone: (31)71-3326236, E-mail: e.meekes@naktuinbouw.nl or Ir. A.F.L.M. Derks, Bulb Research Centre, Vennestraat 22, PO Box 85, 2160 AB Lisse, Netherlands. E-mail: toon.derks@wur.nl E-mail symposium: isvdop12@wur.nl.

- NEW April 20-24, 2008, Lisse (Netherlands): **X International Symposium on Flower Bulbs and Herbaceous Perennials.** Info: Dr. A.T. Krikke, PPO division Flower Bulbs, Professor van Slogterenweg 2, PO Box 85, 2160 AB Lisse, Netherlands. Phone: (31)252462124, Fax: (31)252462100, E-mail: arend.krikke@wur.nl or Dr. Ir. J. Ernst Van Den Ende, Applied Plant Research (PPO), Flowerbulbs, PO Box 85, 2160 AB Lisse, Netherlands. Phone: (31)252-46-2123, Fax: (31)252-46-2100 Web: http://www.isfbp2008.wur.nl/.

- NEW April 27 - May 2, 2008, Westminster, London (United Kingdom): **International Symposium Plants for People and Places.** Info: Mr. Tim Hughes, Royal Horticultural Society, RHS Wisley Garden, Woking, Surrey GU23 6QB, United Kingdom. Phone: (44)01483212335, Fax: (44)01935816684, E-mail: timhughes@rhs.org.uk Web: http://www.plantsforpeopleandplaces.org/.

- NEW May 19-21, 2008, Faro (Portugal): **VI International Symposium on Mineral Nutrition of Fruit Crops.** Info: Prof. Dr. Pedro José Correia, Universidade do Algarve, FERN,, Campus de Gambelas, 8005-139 Faro, Portugal. Phone: (351)289800900, Fax: (351)289-818419, E-mail: pcorreia@ualg.pt or Maribela Pestana, Universidade do Algarve, FERN,, Campus de Gambelas, 8005-139 Faro, Portugal. Phone: (351)289-800900, Fax: (351)289-818419, E-mail: fpestana@ualg.pt Web: http://eventos.ualg.pt/mnutrition6.

- May 21-26, 2008, Pruhonice (Czech Republic): **I International Symposium on Woody Ornamentals of the Temperate Zone.** Info: Dr. Frantisek Sramek, VUKOZ, Res.Inst.Landscape&Ornam.Gardening, Kvetnove Namesti, 25243 Pruhonice, Czech Republic. Phone: (420)296528336, Fax: (420)267750440, E-mail: sramek@vukoz.cz Web: http://www.woodyornamentals.cz.

- June 9-11, 2008, Madrid, (Spain): **IV International Symposium on Applications of Modelling as an Innovative Technology in the Agri-Food Chain - Model-IT 2008.** Info: Prof. Dr. Pilar Barreiro Elorza, c/ Hermosilla 86, 2 E, 28001 Madrid, Spain. Phone: (34)913363260, Fax: (34)913365845, E-mail: pilar.barreiro@upm.es Web: http://www.model-it2008.upm.es.

- June 9-11, 2008, Toronto (Canada): **XI International Symposium on the Processing Tomato.** Info: Dr. Jane Graham, Ontario Food Processors Association, c/o Janisse Routledge, 7660 Mill Rd., Guelph, ONT N1H 6J1, Canada. Phone: (1)5197675594, Fax: (1)5197634164 or Mr. John Mumford, Ontario Vegetable Growers Marketing Board, 435 Consortium Court, NGE 258 London, Ontario, Canada. Phone: (1)519-681 1875, Fax: (1)519-685 5719

- June 16-20, 2008, Matera (Italy): **XIV International Symposium on Apricot Breeding and Culture.** Info: Prof. Cristos Xiloyannis, Dip. Produzione Vegetale, Via N. Sauro 85, 85100 Potenza, Italy. Phone: (39)0971202165, Fax: (39)0971202269, E-mail: xiloyannis@unibas.it E-mail symposium: apricot2008@unibas.it. Web: http://www.unibas.it/apricot2008/home.htm.

- NEW June 16-17, 2008, Vignola, Modena (Italy): **II ISOFAR Conference on Organic Fruits & 16th IFOAM Organic World Congress.** Info: Dr. Franco Weibel, Res. Institute for Orgnic Farming, FIBL, Ackerstrasse, 5070 Frick, Switzerland. Phone: (41)628657272, Fax: (41)628657273, E-mail: franco.weibel@fibl.ch or Dr. Robert K. Prange, Agriculture and Agri-Food Canada, Atlantic Food and

Horticulture Research Centre, 32 Main Street, Kentville, NS B4N 1J5, Canada. Phone: (1)9026795713, Fax: (1)9026792311, E-mail: pranger@agr.gc.ca Web: http://www.isofar.org/modena2008/fruit.html.

- June 23-27, 2008, Viterbo (Italy): **VII International Congress on Hazelnut.** Info: Prof. Leonardo Varvaro, Dipartimento di Protezione delle Piante, Università della Tuscia, via San Camillo de Lellis, 01100 Viterbo, Italy. Phone: (39)0761-357461, Fax: (39)0761-357473, E-mail: varvaro@unitus.it Web: http://www.hazelnut2008.it.

NEW

- July 14-18, 2008, Corvallis, OR (United States of America): **IX International Symposium on Vaccinium Culture.** Info: Prof. Dr. Bernadine C. Strik, Department of Horticulture, Ag. & Life Sci. Bldg 4017, Oregon State University, Corvallis, OR 97331-7304, United States of America. Phone: (1)541-737-5434, Fax: (1)541-754-3479, E-mail: strikb@hort.oregonstate.edu or Dr. Chad E. Finn, USDA ARS, Hort. Crops Lab., 3420 NW Orchard Ave., Corvallis, OR 97330, United States of America. Phone: (1)541738-4037, Fax: (1)541738-4025, E-mail: finnc@science.oregonstate.edu Web: http://oregonstate.edu/conferences/vaccinium2008.

- August 4-8, 2008, Geneva, NY (United States of America): **International Symposium on Integrated Canopy, Rootstock, Environmental Physiology in Orchard Systems.** Info: Dr. Terence L. Robinson, Dept. Horticultural Science, New York State Agricultural, Experiment Station, Geneva, NY 14456-0462, United States of America. Phone: (1)315-787-2227, Fax: (1)315-787-2216, E-mail: tlr1@nysaes.cornell.edu

- August 11-14, 2008, Aarhus (Denmark): **IX International Symposium on Postharvest of Ornamentals.** Info: Dr. Carl-Otto Ottosen, Department of Horticulture, Aarhus University, Kirstinebjergvej 10, 5792 Aarslev, Denmark. Phone: (45)89993313, E-mail: co.ottosen@agrsci.dk Web: http://www.postharvestsympo-sium.dk.

NEW

- August 24-28, 2008, Brisbane (Austria): **VI International Symposium on In Vitro Culture and Horticultural Breeding.** Info: Prof. Acram Taji, Agronomy & Soil Science Group, University of New England, Armidale, NSW 2351, Australia. Phone: (61)267732869, Fax: (61)267733238, E-mail: ataji@metz.une.edu.au Web: http://www.une.edu.au/campus/confco/ivchb2008/.

- August 25-28, 2008, Lima (Peru): **International Symposium on Soilless Culture and Hydroponics.** Info: Prof. Alfredo Rodriguez-Delfin, Univ. Nacional Agraria La Molina, Av. La Molina s/n, La Molina, Lima 12, Peru. Phone: (51-1)3495669, Fax: (51-1)3495670, E-mail: delfin@lamolina.edu.pe Web: http://www.lamolina.edu.pe/hidroponia/ISHS_2008/index.html.

NEW

- August 25-28, 2008, Fuzhou - Fujian Province (China): **III International Symposium on Longan, Lychee and other Fruit Trees in Sapindaceae.** Info: Prof. Dr. Pan Dong-Ming, College of Horticulture, Fujian Agric & Forestry University, Dept. Of Horticulture, Fuzhou, Fujian Province, China. Phone: (86)59183789299, Fax: (86)59183735681, E-mail: pdm666@126.com

- September 1-5, 2008, Dresden, Pillnitz (Germany): **I International Symposium on Biotechnology of Fruit Species.** Info: Dr. Viola Hanke, Baz, Institute for Fruit Breeding, Pillnitzer Platz 3a, 01326 Dresden, Germany. Phone: (49)3512.616.214, Fax: (49)3512.616.213, E-mail: v.hanke@bafz.de Web: http://www.biotechfruit2008.bafz.de.

- September 3-6, 2008, Stellenbosch (South Africa): **IX International Protea Research Symposium and XIII International Protea Association Conference.** Info: Mr. Hans Hettasch, Arnelia Farms, P.O. Box 192, 7355 Hopefield, South Africa. Phone: (27)227231022, Fax: (27)227231022, E-mail: arnelia@intekom.co.za or Dr. Retha Venter, International Protea Association, PO Box 5600, Helderberg, Somerset West 7135, South Africa. Phone: (27)218554472, Fax: (27)218552722, E-mail: reventer@netactive.co.za Web: http://www.ipa2008.co.za.

- September 8-12, 2008, Lillehammer (Norway): **V International Symposium on Brassicas and XVI Crucifer Genetics Workshop.** Info: Dr Magnor Hansen, Agricultural University of Norway, Dept. of Hort & Crop Science, PO Box 5022, N 1432 Aas, Norway. E-mail: magnor.hansen@ipf.nlh.no

- September 9-12, 2008, Beijing (China): **IV International Chestnut Symposium.** Info: Prof. Dr. Ling Qin, Beijing Agricultural College, No 7 Beinong Road, Changpin District, Beijing 102206, China. Phone: (86)1080799136 or 1080799126, Fax: (86)1080799004, E-mail: qinlingbac@126.com Web: http://www.chestnut.org.cn.

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- September 9-12, 2008, Sadovo (Bulgaria): **IV Balkan Symposium on Vegetables and Potatoes.** Info: Prof. Dr. Lilia Krasteva, Institute of Plant Genetic Resources, 2 Drujba Str., 4122 Sadovo, Bulgaria. Phone: (359)32629026, Fax: (359)32629026, E-mail: krasteva.liliya@gmail.com

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- September 9-12, 2008, Cartagena (Colombia): **International Symposium on Tomato in the Tropics.** Info: Prof. Dr. Gerhard Fischer, Universidad Nacional Colombia, Facultad de Agronomia, Apartado Aéreo 14490, Bogota, Colombia. Phone: (57)13165498 or 3165000ext19041, Fax: (57)13165498, E-mail: gerfischer@gmail.com or Dr. Alonso Gonzales-Mejia, CIAT, Dept. Tropical Fruits, recta Cali-Palmira Km. 17, Cali, A.A. 6713, Colombia. Phone: (57)24450000, Fax: (57)24450073

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- September 9-13, 2008, Evora (Portugal): **VI International Symposium on Olive Growing.** Info: Prof. Dr. Anacleto Pinheiro, Universidade de Évora, Departamento de Engenharia Rural, Apartado 94, 7002-554 Évora, Portugal. Phone: (351) 266 760 837, Fax: (351)266 760 911, E-mail: pinheiro@uevora.pt or Dr. Manuel Pedro Fevereiro, ITQB, Quinta do Marques, Aptº 127, 2780 Oeiras, Portugal. Web: http://olivegrowing.uevora.pt.

- September 21-25, 2008, Baoding (China): **I 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: kjliu@hebau.edu.cn

- September 22-29, 2008, Alnarp (Sweden): **IV International Symposium Toward Ecologically Sound Fertilization Strategies for Field Vegetable Production.** Info: Prof. Rolf Larsen, Department of Crop Science, P.O. Box 44, S-230 53 Alnarp, Sweden. Phone: (46)40-415369, Fax: (46)40460441, E-mail: rolf.larsen@vv.slu.se Web: http://ishs2008.slu.se/.

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- October - , 2008, Tbilisi (Georgia): **International Symposium on Current and Potential Uses of Nut Trees Wild Relatives.** Info: Dr. Zviad Bobokashvili, Georgian Res. Inst. Of Horticulture, Dept. Fruit &Vine Crop Germplasm Inv., Gelovani Street #6, Tbilisi 0115, Georgia. Phone: (995)93335793, E-mail: bobokashvili@hotmail.com or Dr. Maya Marghania, Kostava 41, Tbilisi, Georgia. Phone: (995)99905076

- November 3-7, 2008, Bogor (Indonesia): **IV International Symposium on Tropical and Subtropical Fruits.** Info: Dr. Roedhy Poerwanto, Jl. Abiyasa Raya No. 1, Bantarjati, 16143 Bogor, Indonesia. Phone: (62)251328942, Fax: (62)251326881, E-mail: roedhy@indo.net.id

- November 3-28, 2008, Mérida (Mexico): **II International Symposium on Guava and other Myrtaceae.** Info: Dr. Wolfgang Rohde, MPIZ, Calf-von-Linné-Weg 10, 50829 Koeln, Germany. Phone: (49)2215062101, Fax: (49)2215062113, E-mail: rohde@mpiz-koeln.mpg.de or Dr. Jose Saul Padilla Ramirez, INIFAP-Campo Experimental Pabellon, Km. 32,5 Carr. Aguascalientes-Zacatecas, Apdo Postal No. 20 CP 20660, Pabellon de Arteaga, Aguascalientes, Mexico. Phone: (52)4659580167, Fax: (52)4659580167

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