Horticultural Highlights

The Future of Irrigation in Horticulture  •  The Pomegranate: New Interest in an Ancient Fruit  •  Giant Pumpkins: Genetic and Cultural Breakthroughs  •  Opium Poppy: Societal Blessing and Curse  •  Fruit Trees for the Sudano-Sahel Region of West Africa

Symposia and Workshops

Cactus Pear and Cochineal  •  Virus Diseases of Ornamental Plants  •  Mineral Nutrition of Fruit Crops  •  Late Blight  •  Strawberry  •  Strategies towards Sustainability of Protected Cultivation in Mild Winter Climate  •  Model-IT 2008
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Cover photograph: A bowl of pomegranate cultivars representing the diversity of pomegranate fruits grown in Israel, see article p. 12.

Contents

■ News from the Board
3 ISHS Board, Executive Committee and Council Meeting, 2008, R.J. Bogers
5 Alphabet Soup: Acronyms Associated with Horticulture

■ Issues
9 The Future of Irrigation in Horticulture, E. Fereres

■ Horticultural Science Focus

■ Horticultural Science News
16 Giant Pumpkins: Genetic and Cultural Breakthroughs, J. Janick
18 Opium Poppy: Societal Blessing and Curse, G. Finetto

■ The World of Horticulture
24 Fruit Trees for the Sudano-Sahel Region of West Africa
30 New Books, Websites
32 Courses and Meetings

■ Symposia and Workshops
33 VIth Int’l Congress on Cactus Pear and Cochineal
36 VIIth Int’l Symposium on Virus Diseases of Ornamental Plants
36 VIIth Int’l Symposium on Mineral Nutrition of Fruit Crops
38 IIIrd Int’l Late Blight Conference
40 VIIth Int’l Strawberry Symposium
42 Int’l Symposium on Strategies towards Sustainability of Protected Cultivation in Mild Winter Climate
44 Model-IT 2008, Better Equipped for Life…

■ News from the ISHS Secretariat
46 New ISHS Members
47 Calendar of ISHS Events
51 Available Issues of Acta Horticulturae
Robert J. Bogers, ISHS Treasurer

In April of this year the ISHS Board, Executive Committee and Council met in Agadir, Morocco. Important issues to be discussed, in addition to the reports of the President and other Board members and those of the Section and Commission Chairs, were the Society’s involvement in “horticulture for development”, our role in advocacy and relations with other stakeholders in the horticultural science community and the horticultural industry, the International Horticultural Congress in Lisbon, 2010, and the Society’s finances.

The scientific activities of the Society continue to be successful, thanks to a very active group of Section and Commission Chairs and symposium conveners. In relation to this, the years 2007 and early 2008 have been very exciting with respect to the publications of the Society. In 2007, 36 volumes of Acta Horticulturae were published with 41 volumes anticipated for 2008 and we expect continued growth. Scripta Horticulturae is getting off the ground and new volumes have been scheduled. The ISHS has initiated talks with many societies active in scientific fields closely related to horticultural science, and to this end several contracts have been signed that will link their publications more closely to ISHS. Our full scientific programme can be accessed on the ISHS web site.

Our connections with the “research for development” community, through GlobalHort and other outreach activities, are proving helpful, generating international symposia on topics of special interest to that community and gaining individual, institutional and country members in Asia, Africa and Latin America. Recent efforts to raise the Society’s profile in South America have been very successful, with Argentina returning as country member and agreements for co-operation with EMBRAPA (Brazil) and horticultural societies in Argentina and Colombia. Our relations with CTA contribute to promoting horticulture and horticultural research in African, Caribbean and Pacific countries.

In developing countries horticulture can act as engine for the economy: high-value crops like fruits and vegetables, medicinal and aromatic plants and flowers can become valuable export products that bring in the necessary foreign currency. At the same time it is of the utmost importance to maintain the existing scientific capacity in the developed world as the science basis on which future developments will also depend. To that end our members in developed countries have a role to play to promote the interest of governments and young scientists in horticulture, and to stimulate their involvement in horticultural research. The relations of our members with politicians and the general public should be strengthened and used to inform them about, e.g., the impact of climate change on horticulture and public health, and the importance of scientific research to tackle these issues. Horticulture as a career must become an attractive option to students, and position papers could be a useful tool to achieve this by helping to promote a positive image of the sector.

The preparation of the XXVIII IHC is on schedule. The first announcement was printed earlier this year and has been distributed in both printed and electronic form. The Congress will consist of colloquia (plenary sessions on cutting-edge topics presented by world-renowned invited speakers), symposia on specific topics, one-day seminars, workshops and thematic oral and poster sessions. The theme of the Congress will be “Science and Horticulture for People.”

Ample time was devoted to a discussion on the dues structure of the Society. In particular the level of the Country dues has for many years been a matter of concern. From 1994 to 2005 the Country dues had been € 4,085 (Category 1 countries), € 2,610 (Category 2), € 1,310 (Category 3) and € 590 (Category 4), respectively, according to the World Bank list of country incomes. As many countries, in particular those for which national societies have to pay the dues, were experiencing difficulties in finding those amounts of money, in 2005 the dues were lowered to € 2,400, € 1,200, € 600 and (in some cases) a first-year introductory rate of € 0, respectively. In 2006 the ISHS Council accepted a Board proposal to simplify the dues structure and to lower the dues further to € 1200 for all high-income countries, € 600 for all upper- and lower-middle-income countries and € 0 for low-income countries that were not yet ready to pay the country dues. As this still did not solve the problems of some countries it was also decided that a special committee, chaired by the Society’s treasurer, would reconsider the dues structure.

During its meeting in Brazil, October 2007, the Board discussed the various proposals and suggestions made by this Committee. The Board also took into account the wish of Committee members to increase the democratic character of Country representation and decided to submit to the Council a proposal that could be implemented without a change in the present Statutes and which does not alter the “United Nations” model of representation. After ample deliberations the Council accepted the following:

1. The Council will consist of representatives of the country/state members, of representatives of the individual members citizens of non-member countries/states, and of representatives of officially recognised geographical regions (Statutes, article 8.1). Per country/state/region up to three Council members will be elected/appointed according to the procedures of the country/state/region concerned. Each Council member is expected to represent all members in his/her country/state/region.

2. Where there is a national society for horticultural science the country/state/region will be encouraged to consider the possibility of appointing the national society as the organisation that is entitled to elect/appoint one or more of the country/state/region’s Council members.

3. Country dues will be lowered to the same level as the dues for Institutional membership, which will be increased from the present € 160 to € 240. To compensate for the loss of income from Country dues and to encourage members also to become members of their national societies the individual dues will be raised to € 60 per year (developed countries) or two years (developing countries), or € 50 per year/two years for members of affiliated national societies. The new dues structure will be implemented in 2009. The present (2008) individual dues are € 50 per year/two years, or € 45 per year/two years for members of affiliated national socie-
ties. Thus, the increase in individual dues will be € 10 for non-members of affiliated national societies but only € 5 for members of affiliated national societies. Also after this change in dues structure the Society's income from membership dues will still be considerably less than its expenses for membership-related issues. A breakdown of the financial results of the past ten years into membership-/Society-related results and publications-related results, taking into account the staff time involved, shows that the negative results caused by membership-/Society-related activities are more than compensated for by the positive results from publications-related activities (Fig. 1). In other words, the services offered to our members are to a large extent financed by the revenues from our publications. This allows us to keep our membership dues at a relatively low level.

It should be noted that the positive overall result in the years 1998-2006 was used to achieve the Society's goal of having one year's turnover in reserves in order to meet Belgian legal requirements and have a sound basis for future developments. This is reflected in the Balance sheet for last year and previous years, which shows a healthy organisation. The value of cash and deposits (current account plus investment account) has grown from € 862,510 at the end of 2003 to € 1,183,051 at the end of 2007 (Fig. 2). The value of the reserves in our (conservative) investment account has increased from € 210,260 at the end of 2003 to € 805,770 at the end of 2007, including two transfers of € 250,000 each from the current account to the investment account in 2004 and 2006.

During the period 2004-2007 both revenues and expenses have grown (Fig. 3). The increase in revenues stems both from increasing income from membership dues and from higher sales of the Society's publications. In direct relation to this, an increased production of publications meant additional production costs and additional engagement of personnel. The years 2006 and 2007 closed with a positive result of revenues over expenses of € 67,226 and € 497, respectively, after provisions were taken. The results of 2007 allowed us to finance a considerable number of the recommendations of the Strategic Plan (approved by Council in 2006) from this year's revenues. Thus, the higher expenses for General management and Personnel in 2007 were used to implement an important number of elements of this Plan in order to ensure the viability of the Society in the coming years. As a result a range of new products and publications will gradually be introduced.

By the end of 2007, individual membership had increased to 7,273 (2005: 6,151), and the number of organisational members had increased to 157. Thus, those years confirmed the positive trend in membership recruiting of the last years. With 42 Country members in 2007, a small increase in the number of Country members was achieved.
Alphabet Soup: Acronyms Associated with Horticulture

Acronyms make comprehension difficult in many articles in the agricultural and horticultural development community, especially when they are unexplained. Authors assume they are understood in context to the initiated, but this is not always the case. Also many different organizations use the same acronyms. For example if you google ISHS you come up with the International Society for Horticultural Science and the International Society for Humor Studies! The following list is our first attempt to make some order out of chaos. Web links are provided for further information. We invite readers to help us complete this list.

AARINENA Association of Agricultural Research Institutions in the Near East and North Africa [www.aarinena.org]

ABH Associação Brasileira de Horticulura (Brazilian Horticultural Association) [www.abhhorticultura.com.br]

ABS Access and Benefit Sharing [brought upon by CBD and IT-PGRFA]

ACDI (CIDA) Agence Canadienne de Développement International (Canadian International Development Agency) [www.acdi-cida.gc.ca]

ACIAR Australian Centre for International Agricultural Research [www.aciar.gov.au]

ACCSS African Crop Science Society

ADB Asian Development Bank [www.adb.org]

AfDB African Development Bank [www.afdb.org]

AFSTA African Seed Trade Association [www.afsta.org]

AGRA Alliance for a Green Revolution in Africa [www.agra-alliance.org]

AGRIFORD Agri-Agencies for Cooperation in Development [www.agricord.org]

AGHS American Horticultural Society [www.ahs.org]

AIPH International Association of Horticultural Producers [www.aiph.org]

ALAP Asociación Latinoamericana de la Papa (Latin American Potato Association) [www.papalatina.org]

ALVA Arbeitsgemeinschaft für Lebensmittel-, Veterinär- und Agrarwesen (Association of Food, Veterinary Science and Agriculture) – Austria [www.alva.at]

AMITOM Association Mériditaine Internationale de la Tomate (Mediterranean International Association of the Processing Tomato) [www.amitom.com]

APA African Potato Association

Asian Potato Association

APAARI Asia-Pacific Association of Agricultural Research Institutions [www.apaari.org]

APH Asociación Portuguesa de Horticultura (Portuguese Horticultural Association) [www.aphhorticultura.pt]

APS American Phytopathological Society [www.apsnet.org]

American Pomological Society [www.americanpomological.org]

APSA Asia Pacific Seed Association [www.apsaseed.org]

ARC Agricultural Research Council – South Africa [www.arc.agric.za]

Agricultural Research Center – Egypt [www.arcsci.ee]

ARS Agricultural Research Service (USDA) [www.ars.usda.gov]

ASA American Society of Agronomy [www.agronomy.org]

ASAHO Asociación Argentina de Horticulura (Horticultural Association of Argentina) [www.asaho.com.ar]

ASARECA Association for Strengthening Agricultural Research in Eastern and Central Africa [www.asareca.org]

ASHS American Society for Horticultural Science [www.ashs.org]

ASP American Society for Plasticulture [www.plasticulture.org]

ASTA American Seed Trade Association [www.amseed.com]

AU African Union [www.africa-union.org]


AVRDC The World Vegetable Center (previously Asian Vegetable Research and Development Centre) [www.avrdc.org]

AVRDC-RCA The World Vegetable Center - Regional Center for Africa [www.avrdc.org/rica.html]

BARC Bangladesh Agricultural Research Council [www.barc.gov.bd]

BeneluxSHS Benelux Society for Horticultural Science [www.beneluxshs.eu]

BMGF Bill and Melinda Gates Foundation [www.gatesfoundation.org]

BMZ Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development) – Germany [www.bmz.de]

CAAS Chinese Academy of Agricultural Sciences [www.caas.net.cn/engforcaas/index.htm]

CATIE Centro Agronómico Tropical de Investigación y Enseñanza [www.catie.ac.cr]

CBD Convention on Biological Diversity [www.cbd.int]

CBO Community-Based Organization

CCCP CGIAR Climate Change Challenge Program [in the making]

CFAR Center for Applied Research – USA [www.cfar.com]

CGIAR Consultative Group on International Agricultural Research [www.cgiar.org]

CIAT Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture) [www.ciat.cgiar.org]

CIDAR Canadian International Development Agency [www.cida-cida.gc.ca]

CIFOR Center for International Forestry Research [www.cifor.cgiar.org]

CIESM Centre International de Hautes Etudes Agronomiques Méditerranéennes (International Centre for Advanced Mediterranean Agricultural Studies) [www.ciesm.org]

CIMMYT Centro Internacional de Mejoramiento de Maíz y Trigo (International Maize and Wheat Improvement Center) [www.cimmyt.org]
Agriculture is the main user of water worldwide, with about 70% of total water withdrawals, including the water used in livestock and aquaculture production. Water diverted for irrigation is the lion's share of agricultural water use, and, in spite of increased demands from other sectors, notably the environment, it is still the primary user of water on the planet. Because of the increasing demands for food production caused by population growth and by the diet changes of emerging countries such as China, it is anticipated that irrigation water demand will continue to increase in the foreseeable future, albeit at a slower rate than that experienced in past decades. Such prediction is cause of concern in many urban circles, where irrigation is perceived as inefficient and unsustainable. The recent increase in basic food prices and the (transitory) use of biofuels, are two new developments that will contribute to further irrigation expansion, adding more pressure to the fixed and scarce water supplies in many world areas.

It is not easy to quantify the total world irrigated area; the estimates of 250-280 million ha that are often quoted from international organizations such as FAO or the International Water Management Institute (IWMI; Thenkabail et al., 2006). The total area equipped for irrigation exceeded 400 million ha, while more than 485 million ha were detected in 2000 as irrigated lands, including the double cropping areas. Although the methodologies used may have errors and the area compiled included informal irrigation, this discrepancy suggests that there are more irrigated lands than those officially reported by the water authorities of many countries. That is a symptom of uncontrolled irrigation expansion that creates even more pressure on the scarce water resources, and that may be an important source of conflicts in the future. China and India represent more than half of the world total irrigated area, and more than 60% is irrigated only from surface sources, while less than 20% depends exclusively on groundwater.

It should be stated at the outset that irrigation in many semi-arid and in the arid areas is not sustainable in the long run. All irrigation waters contain salts and the evaporation process from the plants and the soil concentrate the salts in the profile. Salt leaching through appropriate drainage networks is therefore needed to avoid soil salinization, and it has been provided in most but not all of the irrigation networks. The new threat to the sustainability of irrigation is that the disposal of the drainage waters, once considered matter of fact, has now become a very serious environmental problem. Return flows from irrigated lands contain not only salts, but sediments, nutrients and pesticides, all having a negative impact on aquatic ecosystems. In a few cases, the water authorities have forbidden the discharge of drainage from irrigated areas, threatening their sustainability. Reducing or minimizing the pollution from irrigation return flows is a challenge that must be addressed by the irrigation community worldwide, which has to internalize the costs of pollution and no longer can ignore the negative impact of irrigation on the environment.

The high water demand from irrigation and its environmental impact must be weighed against the large increases in crop productivity obtained when the water constraint to crop production is removed by irrigation. Crop yields increase two to three times relative to those obtained under rain fed conditions; thus, the contribution of irrigated lands to world food security is essential and would be more so in the future. We must therefore find ways to make irrigation more efficient and more sustainable than it has been in the past, in situations where the rate of irrigation expansion must slow down, and when the investments in irrigation and drainage are also on the decline. Many are the challenges faced by irrigated agriculture, including the modernization of irrigation networks and management, the improvement of water institutions, and the responses to periodic droughts. If the focus is on irrigation of the horticultural sector, two major changes have occurred in recent years that have contributed significantly to industry expansion and to the improvement of productivity. One is the development of groundwater for irrigation, and the other is the introduction of new water saving technologies in horticulture.

In addition to the large expansion of groundwater use for irrigation of the main cereal crops in many Asian countries after the launching of the green revolution, groundwater development at many scales has been the primary source for irrigation supply of horticultural...
crops in both developed and developing countries. The low development and energy costs (until now), and the flexibility in use that groundwater offers relative to the rigid supply in the collective irrigation networks, are key factors that favor the use of groundwater in horticultural irrigation. The two major limitations of many collective networks are the seasonality of supply that limits duration of the irrigation season and thus raising off-season crops, and the rotational delivery that sometimes allows for the development of water deficits between two irrigations, a negative factor given the high sensitivity to water stress of many horticultural crops. Groundwater supply for irrigation has thus been an important source for horticultural crops and has been used rather efficiently, as energy costs are an incentive for water conservation. At the same time, the degree of control that farmers have over irrigation has been important to achieve the recent increases in production and in quality. Nevertheless, the expansion of groundwater use has led to overexploitation in many world areas, and this represents a threat to the sustainability of irrigation. In coastal areas where the climate is favorable for horticultural production and where groundwater development has reached its limits, the risks of sea water intrusion represent a major threat to the industry. The water table decline due to overexploitation has increased the pumping costs at a time when the energy costs are soaring. Water quality degradation is often associated to groundwater overdraft. All of these problems indicate that sustainable groundwater use has reached its limits or even has been exceeded in many areas, and that wise use of the resource is needed to match the demand to the supply available.

Irrigation has been carried out by surface water application for thousands of years. The development of innovative irrigation methods took place early in the second half of the 20th Century, but their expansion and widespread adoption is much more recent. First, sprinkler irrigation followed by microirrigation have caused a revolution in the water application techniques in horticulture. In particular, drip irrigation is now the most common method in the irrigation of fruit trees and vines worldwide. While reliable statistics are lacking, it is estimated that microirrigation is used today in more than 7 million ha worldwide, while thirty five years ago it was used in less than 0.1 million ha. One important, recent development is the production of low-cost, low pressure drip systems for use by small farmers in the developing countries, where microirrigation, now more affordable, is expanding rapidly for horticultural production. The adoption of fertigation, and the more recent introduction of subsurface drip systems offer additional options for more efficient nutrient and water use. The expansion of microirrigation has been so rapid that in some countries, such as Israel or Spain, it is now the most widespread irrigation method. The high frequency of application in these permanent irrigation systems offers the additional advantage of avoiding plant water deficits even in marginal soils of very low water holding capacity. The advances in automation allow the application of water even in pulses every few hours if needed, at no additional cost. The engineering advances described above increase the precision of irrigation to levels that have not been sufficiently exploited in horticulture. The knowledge of the crop water needs and of its responses to water is not as complete yet, and the lack of sufficient research in this area generates significant uncertainties in the water management of many horticultural crops. Farmers then tend to be conservative and to be on the safe side in terms of amounts of applied water. Recent and future advances in crop water status monitoring should permit future improvements in precision irrigation, by
combining very uniform water application with the accurate determination of water needs. In situations where water scarcity is becoming the norm rather than the exception, improving irrigation efficiency would not be sufficient though, simply because water supply would not be enough. In such cases, the use of deficit irrigation strategies is the only viable alternative to sustain irrigated production, particularly in drought years. In particular, regulated deficit irrigation (RDI) offers promise in fruit trees and vines as a practice that can maintain farmers’ income while using less water. Research has developed RDI strategies for some of the main fruit tree crops but there is still a need to extend the results, and to evaluate the long term effects of RDI. Another development in terms of water use is the greenhouse production of vegetables in semi-arid regions, using soilless culture. If drainage waters are regenerated and recycled, the water requirements of those production systems are very low as compared to outdoor vegetable production systems in the same climate (less than 30%). The limits of low water consumption in agriculture may be explored with those systems, where ventilation and thus evaporative loss may be reduced to a minimum (depending on plant protection needs) and even the collection of transpirational water may not be ruled out in the future. In the future, water conservation and efficient water use in irrigation will be critical in face of competing demands from other users. The trend already observed of shifting scarce water resources towards irrigation of high-value crops will increase, providing horticulture with much needed water supplies. The consumption of large amounts of water by crops is unavoidable because it is dictated by the evaporative demand of the environment, and is tightly associated with biomass production and yield. Increases in biomass production per unit water transpired during the next 10-20 years will be small, despite promises from biotechnology. Where water supplies are adequate, the main opportunity to increase water-use efficiency resides in closing the gap between actual and potential yields. In cases of insufficient water supply, deficit irrigation will be a viable alternative. For both situations, vigorous research and extension programs are prerequisites for achieving the goals of making horticultural irrigation more productive and sustainable.

References

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Did you renew your ISHS membership?
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Pomegranate (Punica granatum L., Punicaceae) is an ancient, highly praised plant and fruit. Pomegranate culture and its usages are deeply embedded in human history and utilization is found in many ancient human cultures as food and as a medical remedy. Despite this fact, pomegranate cultivation has always been restricted and generally considered as a minor crop. In recent years pomegranates are increasingly recognized as attractive fruit trees that provide a good combination of tasty and appealing fruit appearance, highly valued health beneficial ingredients and a wide range of usages for the fruit and its products. Pomegranate fruit can be consumed as a fresh whole fruit, juice, juice concentrates, ready to use extracted fresh arils, dried arils, wine, cosmetics and pharmaceutical products and oils. Recent medical research indicates that pomegranate fruit has a wide range of important medical activities such as protection against cardiovascular diseases, anticancer and antimicrobial activities. These recent findings combined with public demand for healthy fruit resulted in a pronounced increase of pomegranate fruit consumption in the western world including countries that traditionally did not consume pomegranate fruit.

### POMEGRANATE DISTRIBUTION AND WORLD PRODUCTION

Wild pomegranates are growing today in central Asia from Iran and Turkmenistan to Northern India. Pomegranate is considered as native to these regions. The ability of pomegranate trees to adjust to variable climatic conditions is reflected in the wide distribution. Culture of pomegranate began in prehistoric times. It is estimated that pomegranate domestication initiated somewhere in the Neolithic Era. The optimal climatic growth conditions for pomegranate exist in Mediterranean like climates. These include high exposure to sunlight, mild winters with minimal temperatures not lower than -12°C and dry hot summers without rain during the last stages of the fruit development (Levin, 2006). Under such conditions the fruit will develop to its best size and optimal color and sugar accumulation without the danger of splitting. Commercial orchards of pomegranate trees are now grown in the Mediterranean basin (North Africa, Egypt, Israel, Syria, Lebanon, Turkey, Greece, Cyprus, Italy, France, Spain, Portugal), and in Asia (Iran, Iraq, India, China, Afghanistan, Bangladesh, Myanmar, Vietnam, Thailand, in the former USSR republics: Kazakhstan, Turkmenistan, Tajikistan, Kirgizstan, Armenia and Georgia). In the New World, pomegranates are grown in the U.S.A., Mexico, Argentina and Chile. Although there is no updated, accurate and direct data on pomegranate growth in the world due to the rapid increase in its production and growth, the current total annual world production of pomegranates is estimated to be around 1.5 million tonnes and the four larger producers of pomegranates are Iran, India, China and the U.S.A. (Table 1).

### NEW DEVELOPMENTS IN POMEGRANATE CULTURE

The developing market and the consequent increase in world production are associated with development of new technologies in fruit processing, fruit storage, agricultural management and horticultural aspects. Some of the new technologies include the development of industrial methods to mechanically extract intact arils in an efficient way and in large quantities, extension of the pomegranate fruit storage period for up to four months, development of new growing methods that produce high yield crop of more than 40 t/ha in successive years, development of new cultivars with high fruit quality and longer production season and development of irrigation methods that enable the usage of recycled water. The new achievements enable growers to produce high quality fruit throughout a longer period of time for growth in regions that previously were not suitable for pomegranate culture. Development of optimal dripping irrigation methods together with usage of recycled water make it now possible to grow high yielding pomegranate water loving trees in arid regions that except for water shortage, are otherwise highly suitable for pomegranate cultivation (Fig. 1 and 2A). Most of the large commercial orchards in Israel, India, and the U.S.A. utilize drip irrigation methods. In certain experiments done in India and in Iran, drip irrigation saves up to 66% of water compared to surface irrigation (Chopade et al., 2001). Some growers prefer to use sprinklers but those cause difficulties in weed control. In view of the global warming phenomenon and the increasing water shortage experienced in many arid and semi-arid regions that are the

### Table 1. Estimated world pomegranate production and export based on research done by Yael Kachel, Department of Market Research, Israeli Ministry of Agriculture.

<table>
<thead>
<tr>
<th>Country</th>
<th>Planted area (ha)</th>
<th>Production (t)</th>
<th>Export (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iran</td>
<td>65,000</td>
<td>600,000</td>
<td>60,000</td>
</tr>
<tr>
<td>India</td>
<td>54,750</td>
<td>500,000</td>
<td>22,000</td>
</tr>
<tr>
<td>China</td>
<td>Unknown</td>
<td>260,000</td>
<td>Unknown</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>6,070</td>
<td>110,000</td>
<td>17,000</td>
</tr>
<tr>
<td>Turkey</td>
<td>7,600</td>
<td>90,000</td>
<td>Unknown</td>
</tr>
<tr>
<td>Spain</td>
<td>2,400</td>
<td>37,000</td>
<td>14,000</td>
</tr>
<tr>
<td>Tunisia</td>
<td>2,600</td>
<td>25,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Israel</td>
<td>1,500</td>
<td>17,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Other¹</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

¹ Egypt, Morocco, Chile, Argentina, Australia
to control pomegranate pests and diseases enables growers to plant orchards in regions that suffer from high infestation of pests and diseases such as the Mediterranean fruit fly *Ceratitis capitata* (Tephritidae: Dacinae) and the pomegranate butterfly *Virachola livia* (Lepidoptera: Lycaenidae). The development of mechanical disruption techniques allows for the production of more than a tonne of arils per day and enables the development of new products such as ready to use extracted arils that were not marketed as such before (Fig. 3). The longer period of pomegranate storage and the development of new technologies offer a much higher marketing flexibility for pomegranate producers and extend the range of markets through all over the world. New storage technology (modified atmosphere packaging) that involves the usage of special bags (Xtend®) that have small pores (microperforation) (Porat et al., 2006; Sachs et al., 2006) was developed. These bags result in the development of 5% CO₂ and 12% to 14% O₂ within the bag surrounding the fruit. The Xtend® packaging reduces weight loss from 7% to 3.5%, reduces scald from 38% to 21% and reduces crown decay when pomegranate fruit were stored at 6°C for 16 weeks. Using either the Xtend® packaging technique described above, or CA conditions of 2% O₂ + 3% CO₂ at 6°C permitted storage of pomegranate fruit for 4 to 5 months with acceptable commercial quality.

**HEALTH BENEFITS AND MEDICAL IMPORTANCE**

Perhaps the aspect that contributed the most to the increased demand of pomegranates all over the world is the renewed interest in its health promoting effects. Traditional usage of pomegranate was already practiced in many human cultures. Recent modern scientific work strengthens the status of pomegranate fruit as an important medicinal fruit that contains valuable medically active compounds. Modern chemical analysis of bioactive phytochemicals produced by the pomegranate tree is just in its beginning. Potentially active phytochemicals found in pomegranates include sterols and terpenoids in the seeds, bark and leaves, alkaloids in the bark and leaves, fatty acids and triglycerides in seed oil, simple gallyol derivatives in the leaves, organic acids in the juice, flavonols in the rind, fruit, bark and leaves, anthocyanins...
and anthocyanidins in the juice and rind and catechin and procyanidins in rind and juice. The level of these compounds in the pomegranate tree may change during the development of the tree, during fruit maturation, under different environmental and cultivation conditions and between pomegranate cultivars (Fig. 4). A large variation among pomegranate cultivars with respect to the level of polyphenols, antioxidant activity, and the corresponding content of phytochemicals such as elagic acid, galagic acid, punicalin and punicalagin have been demonstrated. Potential disease targets of pomegranate compounds include coronary heart diseases, cancer (skin, breast, prostate and colon), inflammation, hyperlipidemia, diabetes, cardiac disorders, hypoxia, ischemia, aging, brain disorders and AIDS (Seeram et al., 2006). The recent encouraging experimental medical data suggesting that consumption of pomegranate juice may have a potential effect on reduction of the progression of prostate cancer and on reduction of risks associated with cardiovascular diseases sparked a dramatic increase of scientific and public interest in pomegranates. This in turn resulted in large increase of consumption of the pomegranate fruit.

### POMEGRANATE CULTIVARS

Pomegranate cultivars are grown in very divergent regions around the globe and their features are widely divergent. Most probably some of the different names of pomegranate cultivars correspond to the same or similar cultivar or a landrace of a particular cultivar. Some of the commonly used cultivars include: ‘Wonderful’ (U.S.A., Israel), ‘Rosh Hapered’ and ‘Acco’ (Israel), ‘Mollar de Elche’ (Spain), ‘Bagua’ (India), ‘Hicanzar’ (Turkey), ‘Manafaluty’ (Egypt) and Iranian late cultivars. ‘Wonderful’ is a late cultivar with sweet sour taste, large size fruit and an appealing appearance. The ‘Wonderful’ cultivar is stored very well for long periods and is highly prized in many countries. In Israel several ‘Wonderful’ types have been characterized and

#### Table 2. Fruit characteristics of different pomegranate accessions grown in Newe Ya’ar.

<table>
<thead>
<tr>
<th>Accession number</th>
<th>Common name</th>
<th>Ripening time</th>
<th>Fruit size</th>
<th>Taste</th>
<th>Peel color</th>
<th>Aril color</th>
<th>Aril size</th>
<th>Peel thickness</th>
<th>Seed hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.G.100-1</td>
<td>Wonderful</td>
<td>Late</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Red</td>
<td>Dark red</td>
<td>Mid.-large</td>
<td>Thin</td>
<td>Medium</td>
</tr>
<tr>
<td>P.G.101-2</td>
<td>Wonderful</td>
<td>Late</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Red</td>
<td>Dark red</td>
<td>Mid.-large</td>
<td>Thin</td>
<td>Medium</td>
</tr>
<tr>
<td>P.G.105-6</td>
<td>No common name</td>
<td>Middle</td>
<td>Large</td>
<td>Sweet</td>
<td>Strong red</td>
<td>Dark red</td>
<td>Very large</td>
<td>Medium</td>
<td>Hard</td>
</tr>
<tr>
<td>P.G.106-7</td>
<td>Malisi</td>
<td>Middle</td>
<td>Medium</td>
<td>Sweet</td>
<td>Pink yellow</td>
<td>Light pink</td>
<td>Very large</td>
<td>Medium</td>
<td>Very soft</td>
</tr>
<tr>
<td>P.G.107-8</td>
<td>Shami</td>
<td>Middle</td>
<td>Medium</td>
<td>Sweet</td>
<td>Dark pink</td>
<td>Pink</td>
<td>Medium</td>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>P.G.116-17</td>
<td>No common name</td>
<td>Late</td>
<td>Large</td>
<td>Sour</td>
<td>Dark red</td>
<td>Dark red</td>
<td>Mid.-large</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.118-19</td>
<td>Hershkovich</td>
<td>Middle</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Dark red</td>
<td>Dark red</td>
<td>Large</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.119-20</td>
<td>Rosh Hapered</td>
<td>Early</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Dark red</td>
<td>Dark red</td>
<td>Large</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.124-25</td>
<td>Rosh Hapered</td>
<td>Early</td>
<td>Medium</td>
<td>Dark pink</td>
<td>Pink</td>
<td>Light pink</td>
<td>Mid.-large</td>
<td>Very thin</td>
<td>Very soft</td>
</tr>
<tr>
<td>P.G.127-28</td>
<td>Black</td>
<td>Very late</td>
<td>Small</td>
<td>Sweet</td>
<td>Black</td>
<td>Pink red</td>
<td>Medium</td>
<td>Thin</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.128-29</td>
<td>Acco</td>
<td>Early</td>
<td>Medium</td>
<td>Sweet</td>
<td>Dark red</td>
<td>Red</td>
<td>Medium</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.130-31</td>
<td>Shani-Yonay</td>
<td>Early</td>
<td>Medium</td>
<td>Sweet</td>
<td>Red</td>
<td>Dark red</td>
<td>Medium</td>
<td>Thin</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.131-32</td>
<td>No common name</td>
<td>Early</td>
<td>Medium</td>
<td>Sour sweet</td>
<td>Bordeaux</td>
<td>White red</td>
<td>Medium</td>
<td>Medium</td>
<td>Soft</td>
</tr>
<tr>
<td>P.G.134-35</td>
<td>Kamel</td>
<td>Late</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Bordeaux</td>
<td>Red</td>
<td>Mid.-large</td>
<td>Medium</td>
<td>Hard</td>
</tr>
<tr>
<td>P.G.135-36</td>
<td>No common name</td>
<td>Late</td>
<td>Large</td>
<td>Sour sweet</td>
<td>Red</td>
<td>Red</td>
<td>Mid.-large</td>
<td>Thick</td>
<td>Medium</td>
</tr>
<tr>
<td>P.G.136-37</td>
<td>Za’ati</td>
<td>Very late</td>
<td>Large</td>
<td>Sour</td>
<td>Pink</td>
<td>Pink</td>
<td>Large</td>
<td>Medium</td>
<td>Very hard</td>
</tr>
</tbody>
</table>
shown to be differing from each other with respect to skin and aril color (Fig. 5 and 6D), time of ripening and some other minor fruit characteristics. ‘Wonderful’ is the mainly produced cultivar today in countries such as the U.S.A. and Israel and is among the main important pomegranate cultivars in the European and American markets. The Indian evergreen cultivar ‘Bagua’ is produced in India throughout the entire year but its fruit qualities particularly with respect to skin color are changed in the different seasons. This is a sweet and relatively small cultivar with a strong red skin and aril color. ‘Mollar’ and ‘Rosh Hapered’ are general names for a series of cultivars with similar features that slightly diverge from each other and are characterized by sweet sour less taste, pink color and large fruit. Recently several cultivars were introduced to commercial growth in Israel that have an appealing taste and color and precede the time of ripening of ‘Wonderful’ by about a month (Table 2, Fig. 6). These cultivars together with cultivars such as ‘Bagua’ are very important for extending the production season and enable much higher flexibility with respect to fruit picking and supply to the markets. Examples for such cultivars are ‘Emek’, ‘Shani-Yonay’ and ‘Acco’. They are characterized by red skin and aril color, early ripening time and soft seeds. The latest cultivar in Israel today is ‘Black’, the black cultivar P.G.127-28 characterized by dark skin color, dark pink arils, sweet taste and soft seeds (Fig. 6).

**FUTURE PROSPECTS**

Despite of the advance in pomegranate production and processing technologies much is still needed to be studied in order to exploit pomegranates and develop this field to its full potential. Perhaps the most challenging of all will be the production of high quality fruit with attractive appearance that will contain relatively high content of healthy ingredients, free of fungicides and pesticides. Such purposes could be achieved more efficiently, by application of modern research technologies to pomegranate research. One of the most challenging aspects of such research is the development of new pomegranate cultivars. There are many cultivars today that are attractive to the consumer and grower. However, cultivars that combine most of the desired features including good taste and color, high content of anti cancer and antioxidant compounds and resistance to major pests and diseases are rare. Modern methods in molecular genetics such as molecular mapping, marker assisted selection (MAS) and biological mutagenesis were not yet applied to pomegranate research. Only few genes from pomegranates were isolated and identified and no Expressd Sequence Tags (ESTs) or other genetic databases were established. Agrobacterium mediated genetic transformation of pomegranate was recently reported by Terakami et al. (2007). Pomegranate cultivars developed through genetic engineering are not expected in the near future. This is due to severe restrictions on commercial usage of genetically modified plants and because transformation systems have not been developed for commercially important cultivars. However, the development of transformation system in ‘Nana’ is expected to be useful as a model system to study genetic manipulation of pomegranate, in identifying important pomegranate genes for future exploitation and for deciphering the function of genes in pomegranates. The full potential of natural variation in pomegranates is not yet fully exploited and the list of available cultivars that could serve as potential parental lines in breeding programs is not yet available and perhaps not yet identified and selected from their natural environments.
The increasing record size of pumpkin has become an intriguing phenomenon over the past 150 years. The recent listing of winners in the Guinness World Records has provided incentive for hundreds of passionate growers worldwide to compete for financial rewards in prizes, returns on the sale of seed, and fame in the world of horticulture. A number of grower organizations are involved and the rules are wide open; nothing is prohibited except adding external weights, although there are careful regulations that require precision for the weighing procedure while rotting pumpkins are disqualified. Competition has become intense and in many ways the phenomenon is similar to sporting events involving racing animals (horses, dogs, camels, and humans) in which industries have been created and sums are wagered (Hill and Bünger, 2004).

Interest in large pumpkins derives from exhibits at state agricultural fairs that became an important part of North American rural life in the 19th century. In 1900, William Warnock, a grower in Ontario, Canada received a special bronze medal from the French government for a 400 pound pumpkin exhibited at the Paris World’s Fair (Fig. 1) and in 1904 provided tips for growers. Since then, a number of contests have been held regularly in the United States and at present pumpkin organizations include the Great Pumpkin Commonwealth (GPC), The New England Pumpkin Growers Association (NEPGA), and The World Pumpkin Confederation (WPC), whose pumpkin weigh off was established in 1983, along with the Riesenkürbis Forum in Germany, and Giant Vegetable Growers of Ontario, Canada. Although the contests are international, most of the records have been achieved in New England located in the northeastern United States, where competition is fierce. The 2007 record (Fig. 2) is an astounding 1689 pounds (766.3 kg). The giant pumpkins have led to bizarre spinoffs including pumpkin cannons and pumpkin boat races (Fig. 3).

**GENETIC MATERIAL**

A number of cucurbit species have large fruit size including Cucurbita pepo and Cucurbita maxima. The contest now is centered on round orange or grey fruits of C. maxima, which has long been known to produce the largest fruit in the plant kingdom. The giant round orange phenotypes of C. maxima appear to be in a narrow gene pool out of ‘Atlantic Giant’ (oblong phenotypes are called ‘Dill’s Atlantic Giant’ developed by William Dill, a Canadian from Nova Scotia, Canada). It is likely that the ‘Atlantic Giant’ and related huge show pumpkins trace their origin to the cultivar ‘Mammoth,’ recorded in the seed trade as far back as 1834 (Tapley et al., 1937). There has been continuous selection for size over a century with no evidence that the gains in record fruit weight, in absolute terms, are slowing down (Fig. 4). In fact, the 2007 record pumpkin exceeded the previous winner by 187 pounds. This large positive trend is suggestive of significant genetic change along with advances in cultivation techniques although definitive tests of trials with older germplasm have not been made. As the competition has increased, breeding and selection efforts have taken place with increasingly large sums paid for seeds of record winners (the record appears to be US$850 for a single seed). Breeding systems have been empirical but recently pedigrees have been established for contest winners, similar to those found in horse racing.

**CULTURAL PRACTICES**

The cultural practices used to achieve fruit size include a number of standard practices in horticulture including improving soil tilth, good nutrition, pruning and fruit thinning, pest control, and season extension by using plastic covers in the spring (Langevin, 2003). Appropriate light and temperature is usually achieved by selection of locations favoring long days, cool nights, and warm sunny days without temperature extremes. Thus, there is clearly a latitude effect in record pumpkin size. There have been attempts to use misting to control day temperature, application of growth regulators, grafting to increase the number of root systems, and there are references to feeding of milk in the popular literature (my favorite is the chapter entitled Summer-Time in the classic 1933 book Farmer Boy by Laura Ingalls Wilder).
Recent record results suggest that a combination of improved culture and genetic change is responsible for the enormous increases in fruit size in giant pumpkin.

As the contest progressed there were a number of goals that seemed unachievable but each has been surpassed with ease. The first goal was the 500 pound (187 kg) pumpkin, quickly followed by 1000 pound (373 kg) and 1500 pound (560 kg). The 2007 record yield of 1689 pounds (764 kg) per day, as compared to about 3.5 pounds (1.6 kg) per day fresh weight with cattle.

### SCIENTIFIC QUESTIONS

The success achieved in increasing the growth of pumpkin fruit is a challenge to horticultural science that has been ignored. An obvious question would be to determine the upper limit of fruit size; another would be to apportion the genetic, environmental, and physiological limits. Perhaps, there is no obvious limit and it might very well be possible to continually expand fruit size if fruit senescence could be deferred or eliminated and increased cell number could be continued indefinitely. Clearly, answers to these questions are being approached empirically by nonacademic horticulturists, and it is time for the academic community to get involved. Someone has accused academics in the agricultural arena of merely proving that the practices achieved by the best growers are correct. I suggest the academic and scientific community cooperate on this engaging problem for the delight of the public everywhere.

**References**


**About the Author**

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Opium Poppy: Societal Blessing and Curse

Giuliano Finetto

Opium poppy (Papaver somniferum, Papaveraceae) is one of the earliest and most famous of cultivated plants (Fig. 1). The products of the plant are widely used for a number of useful products including pharmaceuticals such as morphine and codeine, seed for glazing and fillings of bakery products, oil for cooking, paints, varnishes, and soaps, and as an ornamental (Tétényi, 1997). The alkaloids are of special importance for a broad spectrum of medicinal uses including the alleviation of acute pain and cough suppression. The plant was known to the ancient Greeks for its sleep inducing effect, hence the name “somniferum”; the narcotic effects were attributed to the god Hypnos who personified sleep and dreams. Despite the many valued uses for poppy, the widespread illegal use of opium in the drug culture has long been a societal scourge and the illegal cultivation of opium must be considered as a part of the dark side of horticulture.

OPIUM PRODUCTION

Afghanistan, presently producing about 93% of the world’s poppy crop, is the major source of illegal opium paste used in the manufacture of heroin (Fig. 2) (Finetto, 2005). Fifty years ago, India, Turkey and Iran were the main opium producers and their farmers developed sophisticated agricultural strategy for growing the plants and extracting the latex produced by injuring the capsule and collecting the exudate. Since 1970, as a result of the application of international law on the control of drugs and narcotics, farmers in these countries have been induced to eliminate illegal cultivation based upon government programs to obtain sustainable alternative programs. However, poppy production moved to Southeast Asia (Myanmar, Laos, Thailand) and Afghanistan. From the 1980s, opium production markedly increased, especially in Myanmar and Afghanistan, and from 1990 onward, Afghanistan has become the leading source of opium paste. While production declined during the Taliban hegemony, there is now a sharp increase and this war-ravaged country appears to be rapidly developing into a narco-state. At present Myanmar and India produce only 300 tonnes (t) as compared to over 8000 t for Afghanistan. India and Turkey, traditional producers, still produce licit opium either in traditional ways or from whole plant extraction (poppy straw) defined as “all parts of the poppy after mowing except the seed, from which narcotics can be extracted” (United Nations Opium Conference, 1953).

In the late 1930s, India and Iran production averaged about 25-30 kg/ha of crude opium (adjusted to 30% moisture). However at present, the official average yield in Iran is now said to be around 6 kg/ha suggesting that substantial amounts are not reaching the government. In Turkey, the yield of opium supposedly varies anywhere from 1-16 kg/ha, and the average is about 10, but 20 to 50 kg of opium is the figure given in Turkish agricultural research papers. In Afghanistan, yields are high (42.5 kg/ha as the national average). The potential opium production in Afghanistan for 2007 was 8,200 t, representing an increase of around 34% as compared to 2006.

The 1953 United Nations Opium Conference Protocol (which is still in effect) for limiting and regulating the cultivation of the opium poppy plants, asserts that Bulgaria, Greece, India, Iran, Turkey, the U.S.S.R. and Yugoslavia are the only countries that may legally produce opium for export. However, countries other than these might grow poppy for purposes other than the production of opium, exclusively for seed or oil; Bulgaria, Romania, Japan, Pakistan cultivate...
mainly for seed but also produce amounts of opium for experimentation and for part of their domestic medical needs as well. The only country where substantial amounts of licit opium is now produced for export is India (Table 1), which for all practical purposes has a monopoly on the licit opium destined for international trade.

The demand for natural alkaloids that are obtained from the opium poppy plant (morphine, codeine and thebaine) continues to increase. Global consumption of morphine for the treatment of severe pain also continues to increase. Approximately 80% of the morphine and 93% of the thebaine manufactured worldwide were obtained from poppy straw, while the rest was obtained from opium. Australia, France, Hungary, Spain and Turkey have been the main producer countries, together accounting for over 90% of the world production of poppy straw and of concentrate of poppy straw (a product obtained in the process of extracting alkaloids from poppy straw). In 2005, manufacture of both morphine (401 t) and thebaine (118 t) reached record levels. Manufacture of codeine, which is mainly obtained from morphine through a semi-synthetic process, also reached an all time high of 309 t. Codeine (an opiate used to treat mild to moderate pain, as a cough suppressant and to treat diarrhoea) continues to be the most commonly consumed narcotic drug in the world, in terms of doses and the number of countries where it is consumed. Its use follows a slight upward trend. Both morphine and codeine are used in therapy as well as for conversion into other opioids. Thebaine is not itself used in therapy, but is an important starting material for the manufacture of a number of opioids.

**ORIGIN AND ECOLOGY**

Opium poppy, unknown as a wild plant, is now generally regarded as having originated through cultivation from a Mediterranean species. The truly wild plant (var. *setigerum*) is found on the northern coast of the Mediterranean. It has toothed leaves, the lobes sharp-pointed, each ending in a bristle. The flower stalks and sepals are covered with scattered bristled hairs with 7 or 8 stigmas. *Papaver somniferum* has three varieties: *P. somniferum* var. *nigrum*, a wild form of the opium poppy with purple-red flowers, roundish oblong capsules; *P. somniferum* var. *album*, a wild form with white flowers, roundish oblong capsules; and *P. somniferum* var. *abnormale*, with small red flowers, streaked with dull green and roundish to oblong capsules.

Opium poppy lends itself to cultivation in a broad range of agroclimates but morphine content of opium can vary by a factor of 5 depending on environmental factors. Maximum yields of opium require the right amount of moisture at the appropriate point in its growing cycle, and high temperatures after the plant has flowered. Frost can completely destroy the young plant if the fields are not covered with snow. During harvest, highest yields are obtained on clear, sunny days. Heavy spring rain can result in the development of fungi that constrain production and rain at the flowering stage can reduce the morphine content of the latex. Too much water, or too little, during sowing, germination, rapid vegetative growth, flowering and harvest causes fluctuations in productivity. Although opium poppy is relatively more drought resistant than wheat and other grain crops, drought is detrimental. Irrigation is critical during the period of rapid vegetative growth from the appearance of the stem through capsule development, but excess water in this state leads to disease. Excessive rains during harvest wash away the latex and reduce opium quality. Strong winds can uproot the plant and topple plants when capsules are mature. Although opium poppy lends itself to cultivation in a broad range of soil types poppy does best in

**Table 1. The production of licit opium and opiates from poppy straw during 2004-2007 (Narcotic Drugs Report 2007).**

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (t)</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007 (estimated)</th>
</tr>
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<tr>
<td><strong>Opium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td></td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td>832</td>
<td>332</td>
<td>318</td>
<td>289</td>
</tr>
<tr>
<td>North Korea</td>
<td></td>
<td>0.29</td>
<td>0.34</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td>0.003</td>
<td>0.003</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>Poppy straw concentrate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Australia</td>
<td></td>
<td>124</td>
<td>116</td>
<td>93</td>
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</tr>
<tr>
<td>France</td>
<td></td>
<td>56</td>
<td>53</td>
<td>59</td>
<td>Not available</td>
</tr>
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<td>Spain</td>
<td></td>
<td>36</td>
<td>32</td>
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<td>Not available</td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td>57</td>
<td>71</td>
<td>85</td>
<td>Not available</td>
</tr>
</tbody>
</table>
CULTIVATION

In all countries poppy is grown in small plots. In India the size of a poppy field varies from 0.01 to 10 ha. These same fields are often utilized for food crops during that part of the year when poppy is not cultivated. On rare occasion, a field might be allowed to lie fallow before the sowing of poppy seed. The land is elaborately prepared so as to render it smooth, otherwise the seeds are lost during sowing. In India and Afghanistan field preparation begins in late September; in Iran land preparation extends up to November.

In Turkey, poppy is produced with “heavy” use of manure and/or chemical fertilizers. Many Turkish farmers grow tobacco on the same land after the poppy harvest. In Southeast Asia, poppy is cultivated on inter-mountain plateaus and steep mountain slopes where it is difficult to grow rice, the main staple. Opium poppy is sown in different fields in late August at the earliest to November, usually an alternation with maize.

Sowing

In India the seeds are mixed with soil or sand before broadcasting, to enable a better distribution of the small seeds. About 8 kg of seeds are planted per hectare. The field is then re-plowed or harrowed so as to bury the seed and is then usually divided into squares of 2 to 3 m, leaving an interval that is raised about 15 cm and a channel is excavated on these ridges to convey water to every square from a well near the field. In Western Turkey, fields are hand-seeded by the broadcast method in October. About 1 kg of seed is used per hectare; sometimes the seeds are mixed with sand or ashes in a ratio of about 1 part seed to 4-5 parts dry earth or sand. As much as 25-30 kg of seed per hectare are used if the land is not properly prepared. An improved practice is to plant seed in rows some 60 cm apart, and to thin them to about 25 cm between plants. Another light plowing covers the seeds with a few centimeters of soil, and then an additional final harrowing is carried out.

In Iran, Afghanistan, and China, seeds are broadcast from September to November. In Turkey, seeds are broadcast from October to January. The first sowing is usually done from September to mid-November; the second from December to January and the third sometime between late February and March to mid-April. These staggered sowings help to avoid crop failure but only provide about two weeks difference in capsule maturation time or harvest. Early sowing is generally thought to yield the best crop; autumn planting is carried out in some 60-70% of the opium poppy growing districts, and in late sowing, seeds start to germinate and emerge by mid-November. Irrigation is necessary if there is no rain at the time of sowing.

In Thailand, the opium poppy is generally sown mixed with seeds such as lettuce, parsley, bean, and mustard, and covered up lightly by gentle raking with the fingers. The cultivation and care of these plants is meticulous. In India, Iran and Turkey, young poppy plants that are thinned are eaten in salads and used as potherbs.

Germination

Temperature and moisture are the main factors influencing germination. In India, germination takes place some 5 to 20 days after sowing, depending on soil moisture. Since the poppy does not readily tolerate transplanting, the young plantlets are thinned to about 25-30 cm apart when they are approximately 7 to 14 days old. In Iran, about six weeks after sowing, plants are thinned to about 15 to 22 cm apart. Plants are irrigated in March every 7-10 days and then irrigation is reduced to prevent overgrowth.

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Figure 3. Poppy field in Afghanistan.
The depth of the incision is important; if the incisions are too deep, the latex is exuded to the interior of the capsule and lost and the matura-
tion of the seeds ceases. This means that appro-
riate yields of oil cannot be obtained. If the cut
is too shallow, latex yield will be low. The latex,
which exudes immediately upon cutting, is ini-
tially milky in appearance and accumulates on
the outer wall of the capsule. Although the latex
is initially white or slightly pinkish in appear-
ance, it quickly darkens. Ordinarily 1 or 2
days lapse before a second lancing.

In India the farmers begin at the edge of the
field and work backwards in order to avoid con-
tact with the exuding latex. The hand is quickly
passed over a capsule and a subjective decision
is made as to whether it is ready for incision.
The lancing instrument, called a naštar, is a
homemade gadget comprised of four tines
about the dimension of ordinary needles spaced
a few millimeters apart or so and affixed to a
holder some 18 cm long. About 150 to 200
capsules can be lanced per hour by an ex-
perienced worker. The lancing process is ordinarily
repeated twice, making a total of three series of
vertical incisions.

In Iran, incision is either vertical from top to bot-
tom or diagonal with an instrument having three
or four blades, called agasch. It is carried
out in the late afternoon towards sunset, and the
latex is collected the next morning.

In Turkey, masks are used to prevent inhalation
of excessive vapors. The scalpel-like knife called
a lığı bicag has a small prong protruding about
1.5 mm from the edge of the curved blade. In
eastern Anatolia, a knife having three parallel
blades is used with diagonal gashes but a cir-
cumferential cut is the most common method.

In some areas the circumferential cut is pro-
longed spirally to beyond the starting point.
Turkish farmers incise the capsule a single time
and thus handle a head once. The Turkish
method yields an opium with a higher mor-
phine content, but latex yield per hectare is
lower as compared to India.

In Afghanistan capsules were traditionally
lanced diagonally with a three-pronged blade
and the number of lancings varied from 3 to 6
depending on location. At present, three verti-
cal lancings are performed with an instrument
similar to that used in Iran.

In China, capsule lancing was either horizontal,
perpendicular, or transverse. Ordinarily, the inci-
sions were made with a tool comprised of three
or four small parallel blades in a short wooden
handle, so arranged as to leave the tips exposed
only far enough to effect a cut of the proper
depth.

Scraping and Collection

Scraping (Fig. 3) is arduous because the cap-
sules have to be handled individually. The latex
thus collected is transferred to a pot. The scra-
ping is carried out by grasping the capsule
between the thumb and forefinger of the left
hand and inclining it gently; the scraper is then
drawn upwards. The crude latex generally is col-
duced directly into a small copper or earthen
pot called a hassur and air dried on wooden
boards to the desired consistency. In China the
exuded latex is collected with flat bamboo strips and placed in containers
fashioned out of bamboo cross-sections.

Cultivars

In India (Uttar Pradesh), as well as in Iran, all of
the opium poppy currently cultivated is of the
white flowered type called ‘Teyleigh’ or ‘Telia’,
‘Haraina’, ‘Sufaid-danthi’ or ‘Kattha Bhobutia’,
‘Kutla’, ‘Katli’ or ‘Kottle’, ‘Choura Kutli’,
and ‘Dheri-Danthi’. These have the advantage
of producing only a few capsules per plant and
high content of morphine, which narrows the
harvest period and thus minimizes the need to
“back track” in the lancing operation. In the
Iranian high-plateau area around Isfahan a
crimson-flowered form is cultivated.

Afghan types have white flowers with purple or
deo red lunulae, and speckles instead of a
spot. These types have a short vegetative pe-
riod. In 2007, cultivars preferred by most far-
mers were ‘Watani Soorgula’ (27%), ‘Sebi’
(15%) and ‘Bahrami Soorgula’ (12%). A mor-
phological description of cultivars is shown in
Table 2.

In Southwest Asia, the Yao plant three kinds of
poppy. Flowers are white or purple-red.

Diseases and Pests

Opium poppy is affected by a number of disea-
ses and pests. John Scott’s Manual of Opium
Husbandry (1877) is still the basic source of
information on diseases. Fungal diseases in-
clude opium blight or so-called “downy” mil-
dew caused by Peronospora arboreascens; mil-
dew is caused by the ascomycete Erysiphe poly-
gon; fruit and leaf spots are caused by Entyloma
fuscum (Ustilaginaceae); while Verticillium and
Fusarium species, Dendryphion penicillatum,
and Pleospora calvenses, the perfect stage of
Helminthosporium papaveris, cause serious
disease problems.

Weevils and cutworms (Agrotis suffusa), which
attack young seedlings, are another problem. Heliothis armigera feeds on the young leaves of
poppy plantlets. As the poppy grows and ma-
tures, the insect eats its way up the stem and
ultimately bores its way into the poppy head and
proceeds to destroy the capsule. The cricket
Gryllotalpa vulgaris, a root feeder, causes da-
mage. Parasitic angiosperms, such as Orobanche
eaegyptiaca “broom rape”, attack roots and are
a problem in India and Afghanistan.

Even after the latex is successfully collected and
processed, there is the problem of further con-
tamination with fungi such as Scopulariopsis
brevidicaulis var. glabra, Aspergillus niger, A.
repens, A. flavus, A. wentii, A. ostianus,
Fusarium solani, Penicillium species, Oospora
species. Although the morphine content of
the opium is not greatly affected by these fungi, the
general quality and attractiveness deteriorates.
<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Occurrence (%) area covered</th>
<th>Flower colour</th>
<th>No. sepals</th>
<th>No. petals</th>
<th>Plant height (cm)</th>
<th>Capsule description (height x diam., cm)</th>
<th>No. of incisions, stigmatic rays</th>
<th>Ripening</th>
<th>Opium quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papaver somniferum cv. Persian White</td>
<td>Nangarhar (10)</td>
<td>White</td>
<td>2</td>
<td>4</td>
<td>125-130</td>
<td>5.5x19.5, no/small longitudinal waves</td>
<td>10-13, standing</td>
<td>Early</td>
<td>3-4, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Album</td>
<td>Nangarhar (20)</td>
<td>White</td>
<td>2</td>
<td>4</td>
<td>110-115</td>
<td>6x17, no/small longitudinal waves</td>
<td>10-14, creeping</td>
<td>Late</td>
<td>3-4, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Persian Blue</td>
<td>Nangarhar (60)</td>
<td>Red, white</td>
<td>2</td>
<td>4</td>
<td>110-115</td>
<td>6.5x16, longitudinal waves</td>
<td>11-13, standing</td>
<td>Early</td>
<td>6-9, high opium, low water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Danish Flag</td>
<td>Nangarhar (10)</td>
<td>Whitish-red,</td>
<td>2</td>
<td>4</td>
<td>120-130</td>
<td>6x17.5, more longitudinal waves</td>
<td>10-15, smooth</td>
<td>Late</td>
<td>6-9, high fresh opium</td>
</tr>
<tr>
<td>Papaver somniferum cv. Danish Flag</td>
<td>Nangarhar (negligible)</td>
<td>Purple, black</td>
<td>2</td>
<td>4</td>
<td>100-110</td>
<td>4x9, more longitudinal waves</td>
<td>9-10, standing</td>
<td>Early</td>
<td>1-3, low latex and low opium</td>
</tr>
<tr>
<td>Papaver somniferum cv. Danish Flag</td>
<td>Hilmand, Kandahar (60)</td>
<td>Pink, blotches</td>
<td>2</td>
<td>4</td>
<td>120-122</td>
<td>6x17.5, more longitudinal waves</td>
<td>12-13, standing</td>
<td>Late</td>
<td>7-8, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Lacinatum (single-flowered)</td>
<td>Hilmand, Kandahar (20)</td>
<td>Deep red</td>
<td>2</td>
<td>4</td>
<td>118-122</td>
<td>6x5.5, no/small longitudinal waves</td>
<td>11-14, creeping</td>
<td>Late</td>
<td>5-6, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Lacinatum (late-maturing, single-flowered)</td>
<td>Hilmand, Kandahar (20)</td>
<td>Pink</td>
<td>2</td>
<td>4</td>
<td>118-122</td>
<td>6x5.5, no/small longitudinal waves</td>
<td>11-14, creeping</td>
<td>Late</td>
<td>5-6, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Gigantean (Shawano or Baronial)</td>
<td>Hilmand, Kandahar (20)</td>
<td>Deep pink</td>
<td>2</td>
<td>4</td>
<td>125-128</td>
<td>6.5x7, smooth</td>
<td>11-14, creeping</td>
<td>Early</td>
<td>6-8, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv. Danish Flag</td>
<td>Balkh (30)</td>
<td>Red</td>
<td>2</td>
<td>4</td>
<td>130-135</td>
<td>5.5x19.5, no/small longitudinal waves</td>
<td>10-14, standing</td>
<td>Early</td>
<td>6-8, high opium, low water content</td>
</tr>
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<td>Pink, white</td>
<td>2</td>
<td>4</td>
<td>120-125</td>
<td>6x17.5, no/small longitudinal waves</td>
<td>10-13, standing</td>
<td>Late</td>
<td>7-10, high water content</td>
</tr>
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<td>Balkh (30)</td>
<td>White</td>
<td>2</td>
<td>4</td>
<td>125-130</td>
<td>5.5x19.5, no/small longitudinal waves</td>
<td>2-12, standing</td>
<td>Early</td>
<td>3-4, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (25)</td>
<td>Red, white blotches on the base</td>
<td>2</td>
<td>4</td>
<td>115-120</td>
<td>6x19, no/small longitudinal waves</td>
<td>10-14, standing or smooth</td>
<td>Early</td>
<td>7-10, high opium, low water content</td>
</tr>
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<td>Pink, white blotches on the base</td>
<td>2</td>
<td>4</td>
<td>125-130</td>
<td>6x17.5, no/small longitudinal waves</td>
<td>11-14, standing</td>
<td>Late</td>
<td>8-13, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (30)</td>
<td>White</td>
<td>2</td>
<td>4</td>
<td>125-130</td>
<td>5x16.5, no/small longitudinal waves</td>
<td>12-16, standing or smooth</td>
<td>Late</td>
<td>4-5, high opium, high water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (25)</td>
<td>Purple</td>
<td>2</td>
<td>4</td>
<td>110-115</td>
<td>7x15.5, longer and smoother than the other varieties</td>
<td>12-16, standing first purplish, later becoming green</td>
<td>Late</td>
<td>2-3, low opium, low water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (30)</td>
<td>Red, white blotches on the base</td>
<td>2</td>
<td>4</td>
<td>80-100</td>
<td>5x15.5, no/small longitudinal waves</td>
<td>10-14, standing or smooth</td>
<td>Early</td>
<td>4-5, high opium, low water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (25)</td>
<td>Pink, white blotches on the base</td>
<td>2</td>
<td>4</td>
<td>100-105</td>
<td>6x17.5, no/small longitudinal waves</td>
<td>11-14, standing</td>
<td>Late</td>
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</tr>
<tr>
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<td>Badakhshan (20)</td>
<td>White</td>
<td>2</td>
<td>4</td>
<td>100-108</td>
<td>5x16.5, no/small longitudinal waves</td>
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<td>Late</td>
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<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (25)</td>
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<td>4</td>
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<td>7x15.5, longer and smoother than the other varieties</td>
<td>12-16, standing, first purplish, later becoming green</td>
<td>Late</td>
<td>2-3, low opium, low water content</td>
</tr>
<tr>
<td>Papaver somniferum cv.</td>
<td>Badakhshan (30)</td>
<td>Purple, dark blotches on the base</td>
<td>2</td>
<td>4</td>
<td>110-115</td>
<td>4x9.5, longer and smoother than the other varieties</td>
<td>9-12, standing, first purplish, later becoming green</td>
<td>Late</td>
<td>1-2, low opium, low water content</td>
</tr>
</tbody>
</table>

**References**


**About the Author**

Dr. Giuliano Finetto is a horticultural consultant in tropical and subtropical zones for many international institutions. Dr. Finetto is employed at the Institute of Agricultural Science in Verona, Italy. Email: giulianofinetto@tin.it

[Giuliano Finetto]
Fruit Trees for the Sudano-Sahel Region of West Africa


Along with urbanization, fruit consumption is likely to increase in many developing countries. Agricultural programs in semi-arid Africa as in other developing countries should adapt to this trend of consumer demand. Research institutes should also follow by developing quality material and facilitating its multiplication and sharing.

Fruit trees can be incorporated into rain-fed or irrigated production systems and therefore contribute to income generation for poor farmers. Fruits have an important role in balancing human nutrition. Domesticated indigenous trees can play very important ecological and economic roles. Processed fruit in the form of dry fruit or fruit juices can become a major source of export revenue to the countries of Africa’s Semi-Arid Tropics (SAT). The comprehensive research for development activities carried out by The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is revealing the potential of fruit trees to transform the current cereal based low-value agricultural system of Africa’s SAT into a sustainable, income generating activity.

BACKGROUND

The Consultative Group on International Agricultural Research (CGIAR) Science Council recently recommended the use of fruit trees as a means for reducing poverty in Africa through agricultural diversification and emerging opportunities for high value commodities and products. In semi-arid West Africa, countries such as Burkina Faso, Mali and Senegal are paying increasing attention to fruit production because of its important contribution to food security and income generation for rural farmers. Annual production of fruits in each of these countries ranges from 20,000 to 80,000 tons (FAOSTAT, 2006). In some countries export earning from fruits has been multiplied by a factor of 3 in the last 5 years (World Bank, 2007). Despite the lack of reliable data on fruit consumption in the region, it is expected that along with urbanization, the development of fruit production will increase as it happened in other regions of the world such as India (ISHS, 2005; Dar, 2007). Rural farmers should be the first to benefit from this opportunity.
ICRISAT activities on fruit trees that focus on facilitating sharing of germplasm and building capacity on propagation and nursery management are a unique contribution to the improvement of food security and income generation in the rural areas of semi-arid regions of West Africa. Most fruit trees and other high value plants can be combined with the annual staple crop production thus allowing farmers to increase overall field production and productivity.

In the past many semi-arid countries in West Africa have attempted to develop fruit production (mostly mango and citrus) without great success because of many constraints linked with this sector including the availability of quality and adapted germplasm, insufficient propagation capacity and facilities, inadequate pest and disease management capacities, poor irrigation management, poor postharvest handling capacity (packaging, storage and transport), and poor market access. ICRISAT Sahelian Center (ISC) in Niamey (Niger) is currently contributing to solving the first two constraints by establishing mother plantations for a range of species and cultivars and operating a regional plant nursery.

Since 2001, ISC adopted a program on systems and crop diversification. This program aims at increasing income generation of poor farmers from both dryland and irrigated agriculture, increasing export opportunities, supporting fruit-based agro-industries, and improving the nutritional status of the local population. This program promotes planting of fruit trees and other high value trees in the farmlands. ICRISAT work in the Sudano-Sahel region resulted so far in: (1) collection of cultivars and provenances and maintenance of mother plantation on station; (2) establishment and operation of plant propagation facilities; (3) well trained nursery staff; and (4) the implementation of projects to overcome the arising problems that come along with the promotion of fruit trees in semi-arid West Africa.

**Table 1. Fruit plant accessions in ICRISAT Sadore collection located 45 km south of Niamey.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Common name</th>
<th>Cultivars</th>
<th>Processing</th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anacardiaceae</td>
<td>Mangifera indica</td>
<td>Mango</td>
<td>28</td>
<td>Fresh fruit, dried, juice</td>
<td>Good local, regional and international markets</td>
</tr>
<tr>
<td></td>
<td>Sclerocarya birrea</td>
<td>Marula</td>
<td>3</td>
<td>Fresh fruit, liqueur, juice, oil, bio-ethanol</td>
<td>To be explored in West Africa</td>
</tr>
<tr>
<td>Annonaceae</td>
<td>Annona atemoya</td>
<td>Atemoya</td>
<td>1</td>
<td>Fresh fruit, juice</td>
<td>Potential good regional and international markets</td>
</tr>
<tr>
<td></td>
<td>Annona reticulata</td>
<td></td>
<td>1</td>
<td>Fresh fruit, juice</td>
<td>Potential good regional and international markets</td>
</tr>
<tr>
<td></td>
<td>Lannea microcarpa</td>
<td></td>
<td>1 wild accession</td>
<td>Fresh fruit, juice</td>
<td>Market to be explored</td>
</tr>
<tr>
<td>Apocynaceae</td>
<td>Saba senegalensis</td>
<td>Saba</td>
<td>7 wild accessions</td>
<td>Fresh fruit, juice</td>
<td>Good local, regional and international markets</td>
</tr>
<tr>
<td>Arecaceae</td>
<td>Phoenix dactylfera</td>
<td>Date</td>
<td>13</td>
<td>Fresh fruit, dried</td>
<td>Good local, regional and international markets</td>
</tr>
<tr>
<td>Caesalpinaceae</td>
<td>Tamarindus indica</td>
<td>Tamarind</td>
<td>5 of sweet tamarind</td>
<td>Dried, juice, sauces</td>
<td>Good local, regional and international markets</td>
</tr>
<tr>
<td>Ebenaceae</td>
<td>Diospyros kaki</td>
<td>Persimmon</td>
<td>1</td>
<td>Fresh fruit</td>
<td>Potential good regional and international markets</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Emblica officinalis</td>
<td>Amla</td>
<td>1</td>
<td>Fresh fruit</td>
<td>To be explored in West Africa</td>
</tr>
<tr>
<td>Moraceae</td>
<td>Ficus carica</td>
<td>Fig</td>
<td>31</td>
<td>Fresh fruit, dried</td>
<td>Good local, regional and international markets</td>
</tr>
<tr>
<td>Punicaceae</td>
<td>Punica granatum</td>
<td>Pomegranate</td>
<td>9</td>
<td>Juice, fresh</td>
<td>Potential good regional and international markets</td>
</tr>
<tr>
<td>Rhamnaceae</td>
<td>Ziziphus mauritiana</td>
<td>Jujube, Ber, Sahel apple</td>
<td>10</td>
<td>Fresh and dried fruit, juice</td>
<td>Potential good local and regional markets</td>
</tr>
<tr>
<td>Rutaceae</td>
<td>Citrus grandis</td>
<td>Pummelo</td>
<td>2</td>
<td>Fresh fruit, juice</td>
<td>Good local and regional markets</td>
</tr>
<tr>
<td></td>
<td>Citrus tangelo</td>
<td>Tangelo</td>
<td>4</td>
<td>Fresh fruit, juice</td>
<td>Good local and regional markets</td>
</tr>
<tr>
<td></td>
<td>Citrus reticulata</td>
<td>Tangerine</td>
<td>1</td>
<td>Fresh fruit, juice</td>
<td>Good local and regional markets</td>
</tr>
<tr>
<td></td>
<td>Citrus limon</td>
<td>Lemon</td>
<td>3</td>
<td>Fresh fruit, juice</td>
<td>Good local and regional markets</td>
</tr>
<tr>
<td></td>
<td>Citrus chinensis</td>
<td>Orange</td>
<td>3</td>
<td>Fresh fruit, juice</td>
<td>Good local and regional markets</td>
</tr>
<tr>
<td>Sapotaceae</td>
<td>Manilkara zapota</td>
<td>Sapodilla</td>
<td>4</td>
<td>Fresh fruit</td>
<td>Potential good local and regional markets</td>
</tr>
<tr>
<td>Vitaceae</td>
<td>Vitis vinifera</td>
<td>Grape</td>
<td>8</td>
<td>Fresh fruit, raisins</td>
<td>Good local, regional and international markets</td>
</tr>
</tbody>
</table>

**COLLECTION, PROPAGATION AND SHARING OF FRUIT PLANTS**

**Sadore Fruit Trees Mother Plantation**

The availability of a reliable source of quality material for propagation remains a bottleneck for promoting fruit trees in semi-arid West Africa. Many of the collections established in Guinea, Mali, Senegal and Cameroon between 1947 and 1962 were made of mango cultivars (Rey et al., 2004) but other fruit plants such as Tamarindus indica and Ziziphus mauritiana were neglected.

These early collections have been lost or were poorly maintained. Within the framework of its crop diversification program and as a means to give a base for the development of fruit production for the semi-arid regions, ISC has established a collection of fruit plants at the Sadore Experimental Station located 45 km south of
Niamey. This collection includes not only the well known mango and citrus cultivars but also fruit plants of proven or recognized potential importance for the region e.g. *Ziziphus mauritiana* (jujube), *Ficus carica* (fig), *Punica granatum* (pomegranate), *Diospyros kaki* (persimmon), *Tamarindus indica* (tamarind), *Emblica officinalis* (amla), *Sclerocarya birrea* (marula), *Annona atemoya* (atemoya), and others (Table 1).

**Regional Nursery and Propagation Facilities**

The promotion of fruit tree plantations in many Sub-Saharan African countries is undermined by an inefficient propagation system as well as by lack of good supply of quality plant material for multiplication. Nurseries should have appropriate facilities such as net houses, glasshouses and/or shade and cool areas depending upon the climatic zone.

At ICRISAT Sadore, a nursery complex for plant propagation was established to enable multiplication of the cultivars assembled in the collection and to facilitate sharing of germplasm with nongovernmental organizations (NGOs), National Agricultural Research Institutes and development partners within the region. It also provides an excellent platform for experimenting and for training on fruit tree nursery techniques.

Propagation by cuttings is done in net and glasshouses where humidity and temperature conditions can be improved. In the Sudano-Sahel region rooting rate of cuttings is significantly improved under such conditions. Fruit tree cultivars are usually propagated by grafting, which requires well-trained and skilled nursery workers. A very limited number of nurseries in the region has fulfilled these conditions. ICRISAT training activities on fruit tree propagation techniques that started in 2001 in collaboration with International Program for Arid Land Crops (IPALAC) and other partners such as the US Agency for International Development (USAID), Islamic Development Bank (IDB), The John Paul II Foundation and numerous NGOs are now filling the gap through regional training courses. Around 30 technicians coming from all over West and Central Africa are trained every year. In addition scores of nursery people receive on-the-job training based on requests by various organizations.

**FIELD EVALUATION OF FRUIT CULTIVARS AT ISC**

**Indian Jujube / Pomme du Sahel (Ziziphus mauritiana)**

*Ziziphus mauritiana*, Rhamnaceae, is a shrubby plant indigenous to the tropical semi-arid zones of southeast Asia. Its edible fruits are widely consumed in the Sahel where it is known as jujube. Improved cultivars introduced from India to Israel were distributed over West Africa by IPALAC. Five cultivars, ‘Gola’, ‘Umran’, ‘Kaithely’, ‘Seb’ and ‘Ben-Gurion’, were included starting in 1997. Five additional cultivars were introduced in 2006. The improved fruits are about 10 times larger than the local fruit and are tastier and juicier. Fruit production of mature trees can be as high as 15 t/ha and could provide a good source of income for farmers (Azam-Ali et al., 2006). Yield data in Sadore (Niger) are encouraging (see Table 2).

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Average tree yield (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Drip irrigation 3 years after planting</td>
</tr>
<tr>
<td>Umran</td>
<td>23.6</td>
</tr>
<tr>
<td>BG</td>
<td>24.4</td>
</tr>
<tr>
<td>Gola</td>
<td>23.1</td>
</tr>
<tr>
<td>Kaithely</td>
<td>20.9</td>
</tr>
<tr>
<td>Seb</td>
<td>17.4</td>
</tr>
<tr>
<td>Mean</td>
<td>21.9</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Table 2. Fruit production of 5 different cultivars of *Ziziphus* under irrigated and non-irrigated conditions.

**Tamarind (Tamarindus indica)**

Tamarind is an indigenous fruit plant of semi-arid Africa, commonly used as food additive in Asia and Africa. The export market is continuously growing because of the huge demand from the juice industries all over the world (El-Siddig et al., 2006). There is an increasing interest in the Sudano-Sahelian countries of West Africa in promoting tamarind plantations for juice production, which is unfortunately undermined by the poor quality of the wild cultivars. The selection and use of improved cultivars is of great priority to support the initiatives in tamarind plantations. ISC in collaboration with the Sahelian Fruits consortium (SAFRUIT), a regional project funded by the

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**Pomme du Sahel:** A. Fruit before ripening. B. Dryland plantation intercropped with watermelons. Note earth bunds for water harvesting. C. Juices and nectars from fruit.
European Union (EU), has been given the task to collect germplasm, particularly of the sweet cultivars for performance test within semi-arid West Africa. Recently four cultivars of sweet tamarind have been introduced from USDA-California.

**Fig (Ficus carica)**

The first fig introduction by ISC was carried out in 2002. ‘Brown Turkey’, one of 31 introduced cultivars, performed best. In the Sahel figs give the highest yield during the December–March period of the year. This is a good period for exportation of fresh fruit for Europe since Turkey – the main fig exporter – cannot supply these at that time. However the highest potential for figs is for the dried fruit industry. Selection of high yielding quality fig cultivars for drying is being carried out from germplasm provided by USDA-California.

**Date (Phoenix dactylifera)**

Dates are an important fruit for the population of the Sudano-Sahel region. But currently most of the dates consumed in this region are imported from North Africa and from the Emirates. Ecologically date palm is very suitable for production in the hot climate of the Sahel.

The first date palm plantation was established at Sadore in 2002. So far only two leading cultivars (‘Barchi’ and ‘Medjoul’) were planted. Performance of 6-years-old date plantation that fruited for the first time is quite impressive under drip irrigation with 72% of the date palms bearing fruits and fruit yield varying from 20-30 kg per plant. A comparative trial of 13 selected cultivars will be established in 2008 under drip irrigation.

**Pummelo (Citrus grandis / C. maxima)**

Pummelo is one of the well performing citrus in the poor sandy soil of Sadore (Niger). It can be easily propagated by grafting and starts bearing fruits 2 years after transplanting under drip irrigation. It is very attractive to farmers because of its sweet taste and the huge fruit load during production period.

**DOMESTICATION**

**Potential and Challenges for Indigenous Fruit Trees**

Many indigenous fruit trees are highly valued by farmers who developed local management practices to stimulate production. The efforts made by local farmers to domesticate indigenous fruit trees is usually limited to natural assisted regeneration, and selection based on common desired traits such as fruit taste and size (Boffa, 2000; Maranz and Wiesman, 2003; Ouédraogo, 1995).

The so-called agroforestry parklands are the results of traditional management practices of useful trees in farmlands by local farmers (Nikiema, 2005). Fruit trees commonly found in the parklands of the Sudano-Sahel zone include Vitellaria paradoxa, Parkia biglobosa, Tamarindus indica, Adansonia digitata, Ziziphus mauritiana, and Hyphaene thebaica. Most of them have a high socio-economic value either at local and/or regional level, with demonstrated important contribution to income generation for rural farmers, especially for women. Tree crops of the parklands including fruits contribute 20 to 30% of household income in the rural areas (Boffa, 2000).

Traditional tree management systems cover only those indigenous trees considered to be compatible with the local farming system. Trees whose products are harvested but are removed from farmlands are likely to join the list of the threatened species. Semi-domesticated parkland trees as well as important wild fruit plants should therefore undergo domestication process in order to improve the quality of the fruits and develop appropriate agronomic as well as propagation techniques (Nikiema, 2005).

**Saba (Saba senegalensis)**

Saba senegalensis, Apocinaceae, is a liana that occurs in the Sudan savanna of Africa. It is usually found along seasonal rivers and in open woodland. Because of its climbing habit, it grows very often next to other trees such as Vitellaria paradoxa, Tamarindus indica, Diospyros mespiliformis, and Acacia sp. Saba fruits are appreciated for its tasty sweet-sour and yellow pulp. It is widely consumed as a fruit, used as a food additive, and more recently to make juice that is very much popular in Burkina Faso, Mali and Senegal. Because of the growing success of its juice, Saba fruits are intensively harvested in the wild and sold in urban markets. Saba is ranked by many authors (Bonkoungou et al., 2002; Ouédraogo et al., 2003; Nikiema, 2005) to be among the highest valued indigenous food plants of semi-arid West Africa. Saba fruit is a good source of income for the rural farmers and especially for women who undertake the harvesting and selling activities at local level. The supply of Saba fruit is very limited in time and quantities. Fruits are available only from June till August. Natural populations of Saba are declining and subject to
Table 3. Highlights in fruit trees grafting at ICRISAT Sadore.

<table>
<thead>
<tr>
<th>Fruit species</th>
<th>Rootstock</th>
<th>Grafting method</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annona</td>
<td>Annona senegalensis (local)</td>
<td>Top cleft</td>
<td>Incompatibility</td>
</tr>
<tr>
<td>Citrus sp.</td>
<td>C. volcamenana</td>
<td>Budding</td>
<td></td>
</tr>
<tr>
<td>Grapes</td>
<td>Vitis carriea var. tropical</td>
<td>Chip budding, top cleft</td>
<td></td>
</tr>
<tr>
<td>Kaki</td>
<td>Diospyros mespiliformis (local)</td>
<td>Top cleft</td>
<td>Incompatibility</td>
</tr>
<tr>
<td>Mango</td>
<td>Mango nunkourouni</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mango bouche longue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marula</td>
<td>Sclerocarya birrea (local)</td>
<td>Top cleft</td>
<td></td>
</tr>
<tr>
<td>Tamarind</td>
<td>Tamarindus indica (local)</td>
<td>Chip budding, top cleft</td>
<td></td>
</tr>
<tr>
<td>Ziziphus</td>
<td>Ziziphus spina christi (local)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ziziphus mauritiana (local)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ziziphus mucronata (local)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ziziphus rotondifolia (India)</td>
<td>Top cleft</td>
<td>Incompatibility with Z. mucronata</td>
</tr>
</tbody>
</table>

severe threat because of lack of regeneration in the agricultural lands (Nikiema, 2005).

In order to improve the supply of fruit while ensuring the regeneration of the resource, ICRISAT has started a domestication program on Saba senegalensis in 2004 with short-term objectives to: (1) evaluate variability in fruiting and fruit quality between and within provenances; (2) select high yielding Saba plants; and (3) develop propagation techniques.

**RESEARCH ON PROPAGATION AND MANAGEMENT OF FRUIT TREES**

ICRISAT Sadore research on fruit trees is focusing so far on: (1) adaptation of fruit plant cultivars to drought and poor soil conditions; (2) identification of well adapted rootstocks; and (3) development of suitable agronomical techniques to improve fruit production in a sustainable manner. Evaluation of rootstocks and grafting methods resulted in good propagation techniques for various fruit plants and adapted to local conditions as shown in Table 3.

**FUTURE PROSPECTS**

**Agro-horticulture / Agro-forestry**

Fruit trees have always been part of the traditional agricultural systems in the Sudano-Sahel zone where species such as Vitellaria paradoxa (shea tree), Parkia biglobosa (néré) and Tamarindus indica (tamarind) are managed by farmers because of their irreplaceable contribution to the daily diet, food security, and income generation for the rural populations. In the integrated fruit trees-crops-livestock system developed by ICRISAT and named the Sahelian Eco-Farm (Pasternak et al., 2005), contribution of fruit trees to farmers’ annual profit can be as high as 48%.

**Dry Land Fruit Tree Plantations**

ICRISAT dryland fruit trees system under experiment is testing the performance of fruit produc-
and year round cash flow. The fruit trees enjoy the water, fertilizers and manure provided to the vegetables and cereals. ICRISAT is paying special attention to such farmers’ innovation in order to develop technologies that are suitable to the local environment and can easily be adopted by local farmers.

Dissemination through Nursery Network

The main mechanism for dissemination of the new fruit trees germplasm is through the construction of nurseries in the region. So far ICRISAT/IPALAC supported the construction of 13 fruit trees nurseries in 8 Sahelian countries. The operators of these nurseries were trained at ICRISAT that supplied them with a range of species and cultivars for planting in their mother plantations. Nursery manuals are being developed as field guides for the trainees and for other nursery operators in the region.

Supporting Research on Fruit Processing through Partnership

In partnership with the food technology laboratory of the University of Niamey, Pomme du Sahel, marula and saba fruit are processed into juice.

Acknowledgements

The authors thank their technical staff, IPALAC, USAID, the European Union, and the Finnish Ministry of Foreign Affairs for their support to ICRISAT West and Central Africa Crops and systems diversification program.

References


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


Most will know about apple and grape and peach, some will know about persimmon, avocado and mango, but do you know about mombin, pitahaya or stinking toe? If not then this comprehensive encyclopedia of fruits and nuts will most likely provide the information that you require.

This very comprehensive text, edited by Jules Janick and Robert E. Paull and published by CABI, has 129 contributing authors most of whom are well known in the international horticultural science community. The text is a little unusual in that it is organised alphabetically by family and then by species. However, a very complete index allows entries to also be found by species binomial and by common names. The other unusual feature is that some entries are for what would normally be regarded as vegetable species in some countries and other entries, for example on palm species, challenge the horticulturist to think comprehensively about what should and should not be included in the discipline. These entries are justified in an informative preface.

Each entry follows a fairly standard content: background on the species; statistics in world production and yield; information on uses and composition; details on botanical characteristics (taxonomy and nomenclature, description, ecology and climatic requirements, reproductive biology, and fruit growth and development); and horticultural requirements (propagation, cultivation, training and pruning, nutrition, irrigation, harvesting and postharvest handling, pests and diseases, and cultivars and breeding). Hence all aspects relevant to a commercially significant fruit or nut species are covered and each entry is completed with a list of selected, key references.

The contributing authors have done a fine job of reducing the wealth of information that exists on many of the species to a concise and helpful text that summarises the information of most relevance to a reader who is likely to be seeking information for the first time on a particular species, or is hoping to find details on some aspect of a particular fruit or nut. Where the species is of minor significance, the length of the text is carefully contained in most instances. The editors note that the text is intended for libraries, researchers, students and serious amateurs and, consequently, the use of scientific terms is appropriate and appeared to be accurate and complete. A very helpful glossary of terms is provided at the front of the text for those who may lack familiarity with some botanical, scientific or horticultural terms.

It was encouraging to note that the entries often included information on the claimed health and nutritional benefits of that particular species. In all cases it seemed that the claims were suitably qualified and were often backed up with appropriate references. It was also pleasing to see that reference was made to the use of genetic modification and the application of molecular techniques where these were relevant.

While the editors have clearly worked hard to ensure that the texts followed a standardized content, in some instances excessive detail was provided of specific factors such as individual pests and diseases (for example, the entries for hazelnut and walnut), notwithstanding the fact that the information (in these examples) was accurate and of value to those with interests in plant pathology and entomology.

One minor omission within the sections on horticultural practices, that might be considered in preparing future texts of this type, was any commentary on sustainable or organic production practices. Given the current interest from consumers for produce that is free from pesticides and about production practices that demonstrate careful stewardship of the environment, these are topics that deserve some attention.

Many of the texts on each species were supported with illustrations either in the form of line drawings, black and white photographs or colour photographs, but many were not. This was a major disappointment given the visual beauty of either the trees or the vines, their flowers and/or their fruits. Furthermore, such visual information assists greatly in both teaching and in plant identification. Aside from the omissions of visual material to support some entries, the quality of the material that was used was sometimes very variable – some line drawings are outstanding and others had a wonderful historical context, but others lacked depth of focus and detail or were simply not of a standard that might be expected in a text of this overall quality. As editors, authors and indeed publishers we too often fail in texts such as this to get the balance, quality and quantity of the illustrations to a high professional standard.

Overall this is an essential text for any serious horticultural science or indeed botanical library. It is certainly a text that all fruit and nut scientists will wish to have access to.

It is very well edited with excellent content on many different fruit and nut species. These species greatly enrich our lives through providing essential vitamins, minerals and nutrients, through providing essential daily food intake and, in many cases, through enriching our lives by providing diversity to our diets, visual beauty in the form of diverse vegetation, flower and fruit types, and a myriad of fresh and processed products to simply enjoy.

Reviewed by Ian Warrington, Massey University, New Zealand


Italy is one of the world reference countries for tree crops, both for the economical relevance of its fruit production and for its extended forest areas. The diversity of cultivated species and climates (from temperate to subtropical), the large historical tradition and the many different products and uses of these agricultural systems define Italy as one of the leading Mediterranean countries in fruits and derived products (from olive oil to wine).

This book focuses on the technological transformation experienced by tree crops and their products in Italy since the end of World War II. The book has been published to pay homage to Enrico Baldini, Emeritus Professor of the University of Bologna on his 80th birthday. His outstanding role in this profound change is honored by the 66 authors, many of them disciples of Baldini. The text presents a panoramic and updated view of the current state of tree crops in Italy. The content is organized in six topics and 29 articles [Economics, Policies, History and Legends (4); Environment and Landscape (5); Major Fruit Crops and Products (6); Cultivars, Propagation, Genetic Resources, and Biotechnology (6); Agronomic Resources.
and their Management (5); Forestry, Biomass and Wood Tree Crops (3)]. A biographical profile of Enrico Baldini, including his publications and stressing his fundamental contribution to Fruit Science, completes the book.

Two aspects of merit should be underscored. First of all is the role of scientific research in the transformation of tree crops in Italy in the last 50 years. The conversion of traditional and emipric fruit systems to a modern and competitive fruit production industry is closely associated to the R&D efforts in this country. This emphasis for the change of empirical agricultural practices into the scientifiically sound technological approaches of current fruit production and fruit transformation systems is a leitmotiv in all of the articles compiled in this book. This theme also represents the best homage that can be rendered to Baldini and his generation of scientists. They have succeeded in a Mediterranean country in developing a sound scientific system helpful to horticulture. This merit of the Italian scientific community is recognized worldwide, particularly since the celebration in Florence of the XXIII IHC in 1990.

The latest changes and the current challenges for world agriculture and their impact on Italian tree crops are also an object of consideration by the authors. Thus one finds discussions on present-day and controversial topics such as the conflict between many agricultural practices and sustainability, with particular emphasis on soil erosion in Mediterranean soils, the contradiction between the need for renewal of old groves (particularly in olive) and the concern for conservation of this traditional landscape in the Italian laws, the adaptation of fruit crops to climatic change, the concern about quality and healthy guarantees in the consumption of fruits and their derived products, the need for new cultivars and rootstocks and the prospects of breeding, biotechnology and GMO in fruit and forest production, the need for and the advances in mechanical harvesting in fruit tree crops, the global market for inputs and outputs in fruit and forest productions, the new prospective for pest, weed and disease control and the integrated and organic systems in fruit production, the immediate shortage of water resources for agriculture and the need for efficient irrigation systems and practices, and biomass production.

In summary, this book is a detailed and valuable approach to Italian tree crops and their current challenges and opportunities, which can also apply to other Mediterranean countries. It also recounts a worthy example of the transformation of traditional fruit groves into new competitive systems based on scientific research and development in one of the most important fruit producing countries of the World.

Reviewed by Luis Rallo, University of Cordoba, Spain


A new manual designed to provide a basic understanding of growth and fruit development, as well as practical considerations on pear culture. Publication is addressed mainly to ‘Bartlett’ (Williams’) pear growers but growers of all cultivars will find the information useful. Other fruit manuals in the series include: Tree Fruit Pest Identification and Monitoring Cards; Organic Apple Production Manual; Integrated Pest Management for Stone Fruits; Peaches, Plums and Nectarines: Growing and Handling for Fresh Market; Training and Pruning Almond Trees; IPM for Almonds; Almond Production Manual; IPM for Walnuts; Walnut Production Manual; Disease of Temperate Zone Tree Fruit and Nut Crops; Kiwifruit Growing and Handling; Olive Production Manual.


Strawberry was listed in the International Treaty on Plant Genetic Resources for Food and Agriculture, Annex 1, as a crop of global horticultural significance. The Global Crop Diversity Trust and Bioversity International requested that a global conservation strategy be developed for strawberry. In 2005, the Trust signed a memorandum of understanding with the International Society for Horticultural Science to provide advice on the development of global conservation strategies for horticultural crops. Dr. Hummer, curator for the US strawberry genebank, was appointed by the Trust as coordinator for the development of the Global Strawberry Strategy. An international expert committee meeting was held 5 to 8 July 2006, at the US Department of Agriculture, Agricultural Research Service, National Clonal Germplasm Repository, Corvallis, Oregon. The Global Conservation Strategy for Fragaria (Strawberry) is now published as Scripta Horticulturae Number 6, which is available from ISHS. Additional information about the Global Crop Diversity Trust and their strategies for conservation of economically important food and fiber crops can be obtained from the Global Crop Diversity Trust website at http://www.croptrust.org/main/strategies.php?itemid=82.

NEW TITLES


A new internet website, www.fruitpedia.com, has been launched on 15 May, 2008. The objective of this website is to provide basic information on edible fruits, particularly those which are not known much outside the area of their habitat. The website has been initiated by the Indian horticulturist, Dr. Chiranjit Parmar. At present, the site contains chapters on 200 fruits. Each chapter comprises of 2-6 pages and also contains 2-4 pictures of the fruit. Information in 165 chapters has been compiled personally by Dr. Parmar. Information in the other chapters has been obtained from experts from all over the world.

Dr. Chiranjit Parmar intends to make this website as an online encyclopedia of the edible fruits. His dream is to put information on ALL EDIBLE FRUITS OF THE WORLD at this website. There is no precise estimate about the total number of fruits that are eaten by people all over the world. However, the general view is that this number is around 4000. So it is a gigantic task and may take a few years to complete.

Dr. Parmar has plans to get chapters on various fruits from horticulturists from all parts of the world. He shall be updating the site every week. He is getting quite helpful response from his contacts all over the world. So he is very optimistic that in a couple of years, this website will have information on ALL the edible fruits of the world.

The currently available literature on fruits only carries information on fruits of commercial importance. There are very few books on minor or wild growing fruits. Thousands of wild growing fruits fondly eaten by local people have been ignored. Fruitipedia is going to cover all such fruits.

A translator has also been provided at the website for the help of those who do not have enough knowledge of English. With this translator the information can be read in eleven languages of the world including Chinese and Hindi.

All the ISHS members are requested to contribute articles for Fruitipedia.

FRUITS: INTERNATIONAL FRUIT JOURNAL

FRUITS is a scientific journal for original articles and reviews on fruit crops in temperate, Mediterranean, subtropical and tropical regions that is associated with CIRAD, the French Agricultural Research Centre for International Development, published by EDP Sciences in France, and recognized by the International Society for Horticultural Sciences.

FRUITS has been indexed and abstracted in a number of abstracting and databases. Since January 2008 the journal is being indexed in two major databases of ISI (Institute for Scientific Information): Science Citation Index Expanded and Journal Citation Reports®/Science Edition. Through this recognition the journal hopes to attract the best science in order to be part of the active innovation process, which is required for fostering fruit production and consumption as part of the prosperity in the world. More information about this journal can be found at www.fruits-journal.org

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

ISAFRUIT FORUM: INCREASING FRUIT CONSUMPTION TO IMPROVE HEALTH

ISAFRUIT is a European Integrated Research Project that focuses on all aspects of fruit from its start as a seed till a consumer bites into a juicy end product. It has been awarded under Thematic Priority 5 - Food Quality and Safety of the 6th Framework Programme of RTD (Contract no. FP6-FOOD 016279-2). Approximately 200 researchers from 60 Research and Development Institutions and SMEs in 16 Countries co-operate in this project, which runs from January 2006 until the summer of 2010.

The strategic objective of ISAFRUIT is to increase fruit consumption, searching the improvement of health and well-being of Europeans and their environment, by taking a total chain approach, identifying the bottlenecks and addressing them by consumer-driven preferences.

On 28 October 2008, a joint initiative of ISAFRUIT, the International Society for Horticultural Science and the European Economic and Social Committee will be held in Brussels, Belgium. This Forum will focus on issues related to fruit consumption arising from the ISAFRUIT Project.
The VI International Congress on Cactus Pear and Cochineal and the VI General Meeting of FAO-CACTUSNET was held from October 22 to October 26, 2007 in João Pessoa, Paraíba State, Northeast region of Brazil. Brazil ranks among the top largest cactus producers in the world, with approximately 500,000 ha of cultivated cactus, and most of this crop is used in the region as fodder. Considering the importance of this crop to Brazil, a group of Brazilian institutions led by the Federation of Agriculture of Paraíba State organized the event.

The Congress was very successful with 533 participants from 14 countries, representing 74 different institutions. The following countries were represented in the meeting: Argentina, Australia, Bolivia, Brazil, Chile, Israel, Italy, India, Morocco, Mexico, Peru, South Africa, United States, and Tunisia. Among the participants, professionals and farmers were the largest group with 351 attendees, followed by a group of 149 students, and 33 invited speakers. The scientific program was carefully prepared by the Organizing Committee and FAO-CACTUSNET group, including 10 sessions covering different areas of knowledge such as genetics and breeding, fruit and vegetable production, post-harvest and agro-industry, medicinal, cosmetics, biofuel, pests and diseases, carmine cochineal production and utilization, biology and biotechnology, forage, desertification, and ecophysiology. In order to cover all these areas, 33 speakers were invited and 233 posters presented. Recent advances in science for different cacti uses were presented by the scientists, bringing the attention of the attendees. At the end of the meeting, there was a field tour to visit local cactus fields with 205 attendees.

The general meeting of FAO-CACTUSNET occurred at the end of the Congress. The memories of previous conferences were presented by Dr. Judith Ochoa from Argentina, including several pictures of CACTUSNET members. Other important resolutions also occurred during this session, including the decision regarding the next venue for the Congress, which will be held in India and Dr. Gurbachan Singh, Director of the Central Soils Salinity Research Institute, will be the president.

The Scientific Committee of the Congress is finalizing the editing of the papers, which will be published in a special issue of Acta Horticulturae. Each paper was peer-reviewed by experts from different countries after initial evaluation by the Scientific Committee.

José Carlos B. Dubeux, Jr.
Viruses are a continuous threat for the ornamental industry. Unexpected virus infections may result from cultivation in new areas and/or by changed cultural practices, intensified international trade and reduced use of pesticides. These changes urge to improve certification schemes, detection methods, resistance breeding and integrated vector and virus management. In this context the 12th International Symposium on Virus Diseases of Ornamental Plants was held from 20 to 24 April 2008 in Haarlem, The Netherlands. With 117 participants from 25 countries a new record was set since the 7th meeting in 1988. Both the Scientific Board of the ISHS Working Group on Virus Diseases of Ornamentals and local Organizing Committee were eager to make attendance possible for representatives of countries that recently started virus research in ornamentals. Therefore, two participants were supported financially.

Many participants used the welcome reception on Sunday evening to renew and make new contacts in an informal and friendly sphere, which was typical for this symposium as a whole.

In an introductory lecture, the importance of the ornamental industry for the Dutch economy was set forth by Ir. Sjaak Langeslag, President of the Royal General Bulbgrowers’ Association. The audience was very interested in his estimation of direct and indirect losses caused by virus diseases, which was illustrated with figures from tulip cultivation. He challenged the researchers to look for more practical solutions for growers.

The scientific program included 33 oral presentations and 30 posters and was divided into five sessions. In the session “Viroids and Phytoplasmas” Dr. Ricardo Flores presented recent research on viroids, which was a very welcome update for most of the participants. The session “Detection Techniques” started with an overview of new techniques presented by Dr. John Hammond and included also practical applications and validation of detection methods. Both sessions were a good basis for and introduction to the plenary discussion on “Validation of detection methods, Quarantine and Trade” with Dr. Nico van Opstal, Director-general of the European and Mediterranean Plant Protection Organization, as Chairman. Five participants made and defended a statement which resulted in animated and exciting discussions in which Dr. Abed Gera acted as pace-maker.

In the session “Resistance” Prof. Rob Goldbach presented an informative overview on novel
Visit to the glasshouses of Fides with explanation about the new breeding material and disease control measures.

• Animated discussions during the poster sessions.

Insights in the working mechanisms of natural host resistance to viruses. Dr. Katja Richert-Pöggeler and Prof. Hanu Pappu attracted special attention as they demonstrated the integration of viral DNA of 2 Caulimoviridae in host DNA and discussed the implications of these findings for plant breeding, diagnostics and disease management. In the extensive session “New Viruses/Host plants”, new viruses or known viruses in a new host were identified and characterized in a broad spectrum of ornamental crops. Most of the new viruses belonged to the Potyvirus genus. This provoked discussion about the criteria that are used to make difference between a strain and a new virus in this genus. But, in this symposium it was also shown with molecular techniques that various potyviruses described in literature were identical or strains of the same virus. In the session “Epidemiology/Transmission and Control”, Dr. Yeheskel Antignus gave an overview about the control strategies of plant viruses. Many examples were given of the effect of optical barriers interfering with the landing behavior of flying insects acting as virus vector and the use of UV-absorbing plastics and screens reducing the virus spread within greenhouses.

The technical excursion started with a guided tour at the world’s largest flower auction in Aalsmeer and was followed by a visit to the breeding and propagation enterprise Fides in De Lier. The tour was completed by a visit to WUR Applied Plant Research in Lisse, the center of the oldest Dutch bulb growing area. The timing of the visit could not have been better since tulips, narcissi and hyacinths were in full bloom. The exhibition of virus diseases in a wide range of ornamental crops was a big success.

At the business meeting no decision was made yet for the location of the next symposium; there are 3 candidates for the organization, viz. Norway, Singapore and China. After the business meeting, the congress ended with a visit to the famous bulb flower exhibition “Keukenhof” in Lisse and a congress dinner during a boat trip on canals and lakes near Leiden.

Toon Derks

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The VI International Symposium on Mineral Nutrition of Fruit Crops was held at the University of Algarve (Faro, Portugal) from 19 to 23 May 2008. This symposium was organised by the CDCTPV (Research Center on Plant Production and Technologies), and by the Faculty of Engineering of Natural Resources, under the auspices of the ISHS Working Group on Mineral Nutrition of Fruit Crops.

The fundamental purpose of this symposium was to provide novel insight into nutritional aspects of all fruit crops, having in mind the new concerns of agriculture in this century: the quality of plant commodities, food safety, conservation of soil and water, and the sustainability of the agroecosystems. The scope of this symposium was more expansive than the prece-
Drs. Maribela Pestana and Pedro José Correia, CDCTPV/FERN, University of Algarve, Faro, Portugal, email: fpestana@ualg.pt and pcorreia@ualg.pt

Visit to a citrus orchard at “Quinta Nova”, Algoz (Silves).

The opening ceremony.

Maribela Pestana and Pedro José Correia

Around 150 participants from all continents and from 27 different countries attended the symposium and a total of 40 oral and 80 poster presentations were given at 7 thematic sessions: water saving and mineral nutrition, fertilisation practices and their environmental impacts; nutritional implications of organic management; cycling and traceability of nutrients in Mediterranean-type ecosystems; low input and precision agricultural systems; mineral nutrition and human health and effects of mineral nutrition on fruit quality and nutritional disorders. One opening session was given by Dr. Gerry Neilsen (Canada), who spoke on tomorrow’s challenges in fruit nutrition research. In the last day of the symposium, Dr. Luc Maene (France) presented several aspects concerning fertilizer’s industry and fertilization management.

Each working session was introduced by a keynote lecture. In the session Water saving and mineral nutrition, Prof. Manuela Chaves (Portugal) spoke on the different approaches to increase the efficiency in water use without losing yield or fruit quality. The majority of the presentations of this session focused on irrigation management and its effects on plant and fruit quality. In session 2, Cycling and traceability of nutrients in Mediterranean-type ecosystems, Prof. Hans Lambers (Australia) reviewed the efficient phosphorus-use strategies and adaptations of plants in the Mediterranean environment of Western Australia. Most of the works in this session dealt with plant nutrients demand and nutritional status of fruit tree species. The following session, Low input and precision agricultural systems, was introduced by Prof. Patrick Brown (USA) who addressed important questions about yield variability and its impacts on nutrient use efficiency in fruit tree orchards. Nutrient partition, nitrogen uptake, nitrogen fertilization, and iron deficiency studies were the main topics in this session, but some works on plant nutritional diagnosis were also presented. Prof. Moreno Toselli (Italy) was the invited speaker for the session Nutritional implications of organic management. His lecture was about nutrient management in organic farming, including the effects of organic fertilization on fruit quality. Most of the presentations focused on the effects of organic fertilization on yield and plant nutritional status. In the session Fertilization practices and their environmental impacts, Dr. Victoria Fernandez (Spain) reviewed some of the factors relating to the penetration, distribution and bioactivity of foliar sprays. Most of the presentations were on foliar fertilization effects. In the session Mineral nutrition and human health, Dr. Michael Grusak (USA) gave an overview of the contribution of fruit tree crops to human mineral requirements. Only a few works were presented in this session, which reported some data on antioxidant activities and vitamin C in fruits. In the last session, Effects of mineral nutrition on fruit quality and nutritional disorders, Prof. Esmaeil Fallahi reviewed these aspects in apples, with emphasis to calcium and boron. A large number of presentations were on the effects of mineral nutrition on fruit quality and nutritional disorders.

Two technical tours allowed the participants to visit strawberry and raspberry plants in soilless culture, persimmon trees, avocado trees and citrus tree orchards, and vineyards for wine and table grapes production.

This symposium was an opportunity to launch new ideas and collaborative projects on all aspects of mineral nutrition and the conveners would like to thank the sponsors and all the people involved in this organization.
The Third International Late Blight Conference was held in Beijing from 3-5 April, 2008, and was sponsored by the Chinese Academy of Agricultural Sciences, the International Potato Center, Global Initiative on Late Blight and ISHS. The conference was a great success, with 154 attendees representing 34 countries. Participation in sharing of scientific knowledge was high as there were 14 keynote presentations, 28 oral presentations and 39 posters.

Enthusiasm at the conference reflects the global importance of this disease. Globally, late blight is primary disease of potato and a major constraint of tomato. Present estimates put annual losses due to potato late blight (caused by Phytophthora infestans) and fungicide costs at several billion dollars globally. This is set to increase as the spread of new, more aggressive strains of the pathogen is causing increasing damage worldwide. Furthermore, the consensus of most climate change models is that the highland tropics will get wetter and warmer and these conditions will make it even more difficult for farmers to manage the disease.

This was the third in a series of conferences; the earlier ones in Hamburg, Germany in 2002 and Quito, Ecuador in 1999. The Beijing conference was organized around several major themes, including: epidemiology, pathogen biology and dynamics, resistance breeding, disease manage-
ment, molecular biology & host pathogen interactions and chemical control. Keynote speakers presented advances in research since the previous conferences. Advances in genomics have facilitated the study of the host pathogen interaction. Sequencing of the *P. infestans* genome and that of other *Phytophthora* species has permitted the identification of a large group of effectors, substances secreted into the host to enhance pathogenicity. These are recognized by host resistance genes and there is evidence of co-evolution in the respective arsenals of this host/pathogen arms race.

On the other extreme of the food chain, we also saw how knowledge theory and pedagogical principles have been used to develop improved guides to facilitate building capacity among resource-poor farmers. These guides are particularly appropriate for farmer field schools or other highly participatory methodologies.

There was a strong focus in the meeting on pathogen populations studies, including information on analysis of DNA extracted from herbarium samples, which has changed previous assumptions about historical migrations of the pathogen. Researchers from Europe demonstrated procedures and software for managing pathogen passport and marker data (see http://www.eucablighth.org/EucaBlight.asp). This aroused much interest among the international participants and there are currently efforts to extend and even globalize this technology.

Some presentations and much discussion focused on the use of potatoes genetically modified for resistance to late blight. The use of marker gene free transformation and R genes from crossable species was presented as a cisgenic breeding approach, which could engender less resistance among the public. In addition to public concern, there is also an issue related to the durability of resistance once deployed, and evaluation of deployment strategies (host mixtures or pyramiding) is also an area of intense study. This is an area of clear linkage with the last conference in Hamburg, where cloning of a resistance (R) gene from *Solanum bulbocastanum* was announced. R genes from this species are currently the primary technology for genetic modification currently underway in the public and private sector.

Several papers were also presented on late blight epidemiology. The benefits of simulation modeling were evaluated, as the practical implications of this type of research are frequently questioned. In the case of potato late blight, simulation has played a role as a research tool. Improved computing power and availability of weather data (historical and predicted) will be used to test the potential for using simulation in a Web-based application for practical disease management. Another paper on epidemiology demonstrated how the disease behaves differently in the tropics where crops and disease are present year round.

The meeting ended with a session on future directions, and it was in this forum that we discussed the possibility of a research framework for the global initiative. Several participants are now developing drafts of this framework.

After the conference, about 35 participants travelled to Sichuan province to visit potato fields and research facilities.

Finally, it is important to note that the unique Chinese tradition, culture and hospitality, and the fantastic food, provided an unforgettable context.

All abstracts are available at the GILB Web page http://gilb.cip.cgiar.org/.

Dr. Greg Forbes, Centro Internacional de la Papa (CIP), Apartado 1558, Lima 12, Peru, email: g.forbes@cgiar.org
The VI International Strawberry Symposium (VI ISS 2008) that took place from the 3rd to the 7th of March 2008 at Huelva, Spain, was the summit of a long and hard process that started five years ago. Gaining the ISHS members’ confidence during the Australian meeting to hold this event in 2008, gave us a feeling of a job well done but also an idea of the tremendous effort that this would mean for the next years.

Now, we realise that this feeling was only a part of what really meant organising such an event like the ISHS International Strawberry Symposium. Finally, thanks to the effort of many people and institutions, we achieved all our objectives, and it was a complete success.

In a meeting like that, more important than the amount of scientific work presented is to meet colleagues, technicians, researchers, growers and so on, which gives one the opportunity of sharing experiences and ideas related to research programs or crop problems, and easily finding solutions or new perspectives. Although the new communication technologies make it easy to get in contact with people from all around the world, the personal touch is still important. In this aspect, the Symposium has been an unique opportunity.

Attendance to the meeting has overwhelmed all our expectations, with more than six hundred authors and companions, from more than sixty different countries all over the world, presenting their works. During the scientific sessions, five invited speakers presented talks, sixty six oral communications were attended and two hundred seventy two posters were presented in the seven different scientific topics: Genetics and breeding, Physiology, Nurseries, Soil disinfestation, Crop production, Crop protection and Post-harvest and quality. A one day technical tour took place during the symposium, with four different itineraries allowing to the symposium participants the opportunity of deeply knowing the strawberry crop in Huelva and Spain. Finally an Open Day for growers and public in general took place, in which the book entitled “The Strawberry Crop in Huelva” was presented, with English and Spanish versions.

The symposium motto “Quality, Health and Environment” underlined the importance of working together to achieve strawberries of excellence, with a higher influence on the well-
being of consumers all inside the reference of a sustainable and environmentally friendly agriculture, and this motto also followed the symposium conclusions, like the influence of global weather change on the strawberry crop, more efficient and better adapted to new social challenges production systems (like new cultivars, no more use of banned pesticides, null residues on fruits, biological control of pests and diseases, etc.) and the nutraceutical importance of strawberries as a healthy fruit.

I would also like to mention the incorporation of new countries, especially developing countries that were not often present in scientific events like the VI ISS, and that are interested in the more technical aspects of the crop, like new cultivars and new production systems. It has been a great effort for many of these attendees to be present in Huelva, but maybe this is a call of attention for other countries for what the future will be in a more and more “global world”.

I would like to thank all people who put their confidence in us, as well as all people, institutions and sponsors for their interest, time and the effort they made. Without them, this event could not have taken place. I want to mention the International Society for Horticultural Science, the Spanish Society of Horticultural Science, the Consejería de Agricultura y Pesca, the University of Huelva, the Consejería de Innovación, Ciencia y Empresa (IFAPA), the Diputación de Huelva, Freshuelva, the Ministerio de Agricultura, Pesca y Alimentación, Cajasol, Fundación Caja Rural del Sur, Grupo Medina, Cora, Inotalis and Eurosemillas.

I do not want to forget our dearest friend Dr. Jean Claude Navatel who unfortunately passed away during the celebration of the symposium. I want to give the best and deepest wishes from the entire strawberry world to his widow and sons.

Finally, a call to remind all the ISHS members that the VII International Strawberry Symposium will take place in Beijing, China, in 2012. I am sure we will all meet again in four years.

José López Medina
Protected cultivation has rapidly expanded in suitable regions all over the world. Formerly the major objective was crop improvement through enhanced growth and efficient pest and disease management. On the other hand, climate control was and still is today a heavy issue. Nowadays, environmental concerns play an important role in the trade since it is also reflected on consumers’ demands besides product quality and safety. The future developments seem to be under the pressure of increased international competition where production cost possesses a significant share and particularly high in some countries, remarkable attention of the consumers to the produce quality and safety and the sustainability of production processes as well as the supply chain. In this scenario, the priority is focused on possible strategies that suit improved efficiency of production systems.

The International Symposium on “Strategies towards Sustainability of Protected Cultivation in Mild Winter Climate” was organized by the Faculty of Agriculture, Ege University and ISHS in Antalya, Turkey on 7-10 April, 2008 collaborating with FAO (Food and Agriculture Organization of the United Nations), TUBITAK (The Scientific and Technological Research Council of Turkey), Turkish Society for Horticultural Sciences and BASF The Chemical Company. IPM Russel, Delta T Devices and Koppert also supported the Symposium.

The symposium was opened with an address by Prof. Dr. Y. Tüzel, Convener, who welcomed all participants on behalf of the Organizing Committee; the speech on behalf of the Protected Cultivation Commission was given by Dr. N. Castilla, Chair of the Commission. As the Chair of the Working Group on Protected Cultivation in Mild Winter Climates, Assoc. Prof. C. Leonardi welcomed the participants. Subsequently Prof. W. Schnitzler (Chair of the ISHS Commission Plant Substrates and Soilless Culture) gave an overview of ISHS activities. Mr. W. Baudoin represented FAO in welcoming to the Symposium.

There were more than 135 participants from 5 continents and 35 countries as Albania, Algeria, Bahrain, Bosnia Herzegovina, Bulgaria, Canada, Croatia, Czech Republic, Egypt, Germany, Greece, Hungary, India, Iran, Ireland, Israel, Italy, Jordan, Korea, Libya, Macedonia, Moldova, Netherlands, New Zealand, Oman, Romania, Saudi Arabia, Serbia, Slovenia, Spain, Sweden, Tunisia, Turkey, UK and USA.

Sessions were devoted to structures, covering materials & screens, environmental control, stress factors, irrigation and nutrition management, soilless culture, seedling & grafting, produce and process diversification, pest & disease management and marketing. Each day, the Scientific Program started with invited papers.
All the participants agreed on the following as the concluding remarks of the Symposium:

- Both crop management and greenhouse structure in mild winter climate can be improved. Simple models could contribute to fulfill this task.
- Semi and closed greenhouse systems could also be proposed for mild winter climates to economize production.
- Soilless culture currently seems one of the safest and most effective alternatives to MeBr. Nutrient solution recycling systems are more and more considered by the scientific community as ready for practical use.
- Different ‘tools’ (i.e. sensors) can be used to increase water and nutrient use efficiencies.
- Grafting could also be a tool against stress.
- Good Agricultural Practices will receive considerable attention to meet retailer and consumer demands for quality and healthy produce.
- Protected cultivation needs to diversify the process and produce to meet the changing demands of the consumers.

A Turkish night with folkloric dances and henna ceremony for the bride accompanied the farewell dinner, which was organized in a historical building at the port. The surprise of the night was the regional dance performance of the Organizing Committee. ISHS medals and certificates were also presented to the Symposium Conveners during the Farewell dinner.

After the scientific sessions, a daily technical tour allowed the attendants to see the expansion of protected cultivation along the southwest coast of Turkey. The visits were focused on soilless culture (RS Tarim), young plants nursery, grafting (Antalya Tarim) and production of cut roses and anthuriums (Ayer Tarim). The participants enjoyed visits to Zenon’s theater (Aspendos), one of the well-conserved antique theaters in Turkey, where even today sound acoustic is still perfect. It was nice to have a drink at Manavgat Waterfall with white foaming water rushing powerfully over the rocks.

Participants coming from various countries expressed their appreciation to the organizers both in respect to the scientific quality of the presentations and social activities. The organizers, on the other hand, would like to extend their thanks to all participants and contributors for a very fruitful and enjoyable meeting and look forward for the next meeting.

Yüksel Tüzel, Aysçe Gül and I. Hakkı Tüzel

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Greenhouse visits of participants.
The 4th International Symposium on Applications of Modelling as an Innovative Technology in the Agri-Food-Chain (Madrid, Spain) was hosted by the Universidad Politécnica de Madrid as an initiative of Working Group 5 of COST action 924. The earlier Model-IT symposia were organized in The Netherlands (1998), New Zealand (2001) and Leuven (2005), and their results and publications by ISHS have shown that the tradition that started ten years ago is still attractive. Model-IT 2008 was organized under the aegis of a number of international and Spanish professional institutions (ISHS, IIR, EurAgEng, ESCH, and SEA), which emphasizes the broad goal of Model-IT to cater the wider agri-food chain with new modelling concepts. For proper chain management, good and reliable predictive models covering all aspects of the food chain are necessary to control and optimise the food chain, going from farm to fork, with respect to quality and safety. This wide range was mirrored by the expertises displayed in the various conference contributions.

In total, 41 oral and 20 poster presentations were presented during the three day symposium attracting 100 participants coming from 23 countries from all over the globe. Although the number of participants was limited, the quality of interaction was inversely proportional to this. The symposium offered three invited speakers highlighting the application and potential of modelling within their own domain.

Theo Geisel, Director from the Max-Planck-Institute for Dynamics and Self-Organization and Professor of Theoretical Physics, University of Göttingen, gave an interesting talk on complexity observed in modern epidemics. By combining simple kinetic models for the transfer of diseases with the more complex approach of super diffusion to account for modern human travel, it comes within reach to forecast the geographic spreading of modern epidemics. This concept was illustrated using historical data on the spreading of US dollar bills.

José Miguel Aguilera, Professor of civil industrial engineering at the Catholic University of Chile, talked about microstructures in food. After a more general introduction into microstructures and food processing showing the increasing opportunities of designing functional microstructures to satisfy the growing demands in the food industry, he took us along into his recent area of interest of gastronomic engineering. In this area he works together with famous chefs to apply scientific principles to achieve provocative sensations in food tasting and with that made everyone’s mouth water.

Finally Francisco José Vico, leader of the Research Group in Biomimetics and Associate Professor at the School of Computer Science both of the University of Málaga, Spain, gave an intriguing overview of biomimetics. Biomimetics is a relatively new science that studies biological systems to imitate them and to take creative inspiration from them to solve human engineering problems. In this way man can learn from the refined systems developed by nature over millions of years. What better model could there be?

Furthermore, the symposium offered the participants four workshops specially prepared for this occasion. The workshop on Data Mining gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets. The workshop on Calibration Transfer in Spectrometric Devices gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets. The workshop on Data Mining gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets. The workshop on Calibration Transfer in Spectrometric Devices gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets. The workshop on Calibration Transfer in Spectrometric Devices gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets. The workshop on Calibration Transfer in Spectrometric Devices gave a practical introduction to a number of techniques for multivariate analysis, both supervised and unsupervised, to explore large amounts of data and to extract relevant information from non random behaviors. These techniques have enabled the transfer of scientific methodologies from the laboratory to the industry by revealing the latent information hidden within large data sets.
focused on fundamental causes for the spectral variations between two spectrometers and how these differences can be overcome by calibration transfer. This is of the utmost importance to allow comparison of results obtained with different devices, ensuring reproducibility and robustness of the results in different campaigns. A third workshop on Image Processing of Multi- and Hyperspectral Vision provided a general overview on the multi- and hyperspectral vision techniques applied in the agri-food sector. Participants were to work with several relevant image processing techniques including the extraction of parameters for the characterization of both internal and external quality in agricultural products. Finally, a workshop was presented on Kinetic Model Development and Calibration Based on Ordinary Differential Equations. The use of these equations is widely spread for the development of kinetic models. A general introduction was given on the power and pitfalls of ordinary differential equation (ODE) based models using hands-on exercises after which the participants were to implement their own model.

After three days of an intensive and successful symposium the participants were sent away with a take home message from Goethe to venture ourselves into knowledge and science to return better equipped for life and to meet again at the next Model-IT symposium to be held in Paris, France in 2011!

On behalf of the Organizing Committee of Model-IT 2008, Pilar Barreiro Elorza and Maarten Hertog

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The Patriarch Still Wants to Live!

During the 27th International Horticultural Congress held in Seoul in 2006, and in my capacity as Chair of the ISHS Section Nuts and Mediterranean Climate Fruits, I suggested to organize a Symposium with the topic "Current and Potential Uses of Nut Trees Wild Relatives". Two countries offered to host the event: Iran and Georgia. Both countries dispose of an extraordinary richness in plant germplasm, an important aspect to attract the scientific community to participate in a transversal Symposium like this. The Board and Council of the ISHS voted in favour of Georgia because, up to now, there had been no opportunity to organize an ISHS conference in this country.

The Symposium, which has the scope to focus the attention of the scientific world on the high potential (for breeding, landscape, uses and traditions, etc.) hidden in Crop Wild Relatives, has been set in the calendar for October 2008.

The two Conveners appointed, Dr. Zviad Bobokashvili, researcher at the Georgian Research Institute of Horticulture, Department of Fruit and Vine Crop Germplasm; and Dr. Maya Marghanaia of the Georgian Ministry of Agriculture, worked hard to get this conference on track for the last two years and were indeed very close to harvest the fruits of their efforts to unite participants to discuss a highly pressing topic: some issues in the vast area of plant genetic resources. The arguments used in the preliminary documents of this meeting were adopted by a number of scientists and later also politicians of the region showed their full interest, resulting in already a number of political initiatives targeted at the safeguard of genetic resources. In line of what is happening in the international area, the International Treaty, signed in the realm of the FAO, calls on all international area, the International Treaty, signed in the realm of the FAO, calls on all countries to safeguard and sustainably utilize plant genetic resources in order to be able to hand them over to future generations. Often, however, man loses the light of reason, and in a second, destroys the patient work of years.

The war between Georgia and Russia is a terrible event that the scientific world cannot accept. Raising arms to solve controversial issues between countries is not the way to go. The course of history, however, interferes today with the Symposium of Tbilisi, Georgia and forces us to put things on hold.

When I was a boy, my father taught me to hand them over to future generations. Often, however, man loses the light of reason, and in a second, destroys the patient work of years.

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ISHS is pleased to welcome the following new members:

**NEW INDIVIDUAL MEMBERS:**

- **Argentina:** Ms. Silvia Hong, Dr. Maria Cecilia Rousseauss; **Australia:** Mr. Andrew Douglas; Dr. James Scott Hanan; Mr. Matthew Hanaford; Mr. Andrew Thompson, James Lisle Thompson; **Bulgaria:** Dr. Vania Kamenova; Mr. Rosen Radev; **Canada:** Mr. Ali Alamoudi; **Chile:** Mr. Ali Amouri; **Colombia:** Mr. Javier Mauricio Aguirre; **Cyprus:** Mr. Koullis Phylactou; **Croatia:** Mr. John Leach; **Czech Republic:** Mr. Karel Konrad; **Ecuador:** Mr. Patrice Brosseau; Prof. Dr. Juan Villalvazo; **Egypt:** Mr. Ali Bennani Smires; **Finland:** Mr. Jari Välimäki; **France:** Mr. Patrice Brousseau; **Germany:** Ms. Silke Kuma; **Greece:** Ms. Françoise Petter; **Greenland:** Mr. Laszlo Adel; **India:** Mr. Rajan Datar; **Iran:** Mr. Mohammad Kaseri; **Israel:** Dr. Eran Goumeriki; **Italy:** Dr. Damiano Gualtieri; **Japan:** Mr. Yuki Kashiyama; **Kenya:** Dr. Brian Joseph Jones; **Korea (Republic of):** Mr. Minjeong Kang; **Lebanon:** Mr. Ali Bannani; **Lithuania:** Mr. Rokas Gudaitis; **Malaysia:** Ms. Anna Johnson; **Mauritius:** Dr. Yuki Kashiyama; **Mexico:** Dr. Brian Joseph Jones; **Moldova:** Mr. Ion Chirila; **Morocco:** Mr. Ali Bennani; **Netherlands:** Mr. Ali Alhamoudi; **New Zealand:** Mr. John Leach; **Nigeria:** Mr. John Leach; **Norway:** Ms. Pamela Akin-Idowu; **Pakistan:** Mr. Ali Alamoudi; **Peru:** Mr. Ali Alamoudi; **Philippines:** Mr. Eduardo Fajardo; **Poland:** Mr. Adamo Domenico Paolo; **Portugal:** Mr. Ivo Pimentel; **Qatar:** Mr. Ali Alhamoudi; **Romania:** Mr. Adrian Bode; **Russia:** Mr. Vasiliy Svergun; **Saudi Arabia:** Mr. Jean de Saxce; **South Africa:** Mr. Nel Buks; **Spain:** Mr. Deon Coetzee; **Sweden:** Mr. Andrey Lebedev; **Switzerland:** Mr. Peter Boll; **Turkey:** Mr. Yuki Kashiyama; **United Arab Emirates:** Mr. Husein Karimjee; **United Kingdom:** Ms. Kate Boothman Meier; **United States of America:** Dr. John Moussouris; **Uruguay:** Mr. Yuki Kashiyama; **Vietnam:** Mr. Husein Karimjee; **Zimbabwe:** Mr. John Beuttenmuller.

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YEAR 2008

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@baefz.de
Web: http://www.biotechfruit2008.baefz.de

September 1-5, 2008, Gent (Belgium): II International Humulus Symposium. Info: Dr. Denis De Keukeleire, Ghent University, Laboratory of Pharmacognosy and Phytochemistry, Harelbekestraat 72, 9000 Ghent, Belgium. Phone: (32)478369850 or 92648055, Fax: (32)92648192, E-mail: denis.dekeukeleire@ugent.be or Dr. Kim Hummer, USDA ARS NCRG, 33447 Peoria Road, Corvallis, OR 97333-2521, United States of America. Phone: (1)541.738.4201, Fax: (1)541.738.4205, E-mail: kim.hummer@ars.usda.gov
E-mail symposium: arne.heyerick@ugent.be

September 3-6, 2008, Stellenbosch (South Africa): I International Protea Research Symposium and XIII International Protea Association Conference. Info: Mr. Hans Hettasch, Arnelia Farms, PO. 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, Heldeberg, 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@umb.no E-mail symposium: brassica2008@umb.no
Web: http://www.ishsbrassica2008.no/

September 9-12, 2008, Plovdiv (Bulgaria): IV Balkan Symposium on Vegetables and Potatoes. Info: Prof. Dr. Liilya Krasteva, Institute of Plant Genetic Resources, 2 Drujba Str., 4112 Sadovo, Bulgaria.
Phone: (359)32629026, Fax: (359)32629026, E-mail: krasteva.liilya@gmail.com
Web: http://www.4bsvp.org/

September 9-13, 2008, Evora (Portugal): VI International Symposium on Olive Growing. Info: Prof. Dr. Anadeto Pinheiro, Universidade de Evora, Departamento de Engenharia Rural, Apartado 94, 7002-554 Evora, 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, Apt° 127, 2780 Oeiras, Portugal. Phone: (351)144694497, Fax: (351)14411277, E-mail: psalema@tbq.unl.pt Web: http://olivégrowing.uevora.pt

September 9-13, 2008, Villa de Leyva (Colombia): International Symposium on Tomato in the Tropics. Info: Prof. Dr. Gerhard Fischer, Universidad Nacional Colombia, Facultad de Agronomía, Apartado Aéreo 14490, Bogotá, Colombia. Phone: (57)13165498 or 3165000ext19041, Fax: (57)13165498, E-mail: gerfischer@gmail.com or Dr. Alonso Gonzales-Meja, CIAT, Dept. Tropical Fruits, recta Cali-Palmira Km. 17, Cali, A.A. 6713, Colombia. Phone: (57)24450000, Fax: (57)24450073 E-mail symposium: soccolhort@gmail.com
Web: http://www.soccolhort.com/tomato/

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-253 50 Alnarp, Sweden. Phone: (46)40-415369, Fax: (46)40460441, E-mail: rolf.larsen@vv.slu.se Web: http://www.ishs2008.slu.se/

September 25-28, 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: qinlingba@126.com E-mail symposium: chestnut2008@126.com
Web: http://www.chestnut.org.cn

October 5-8, 2008, Tbilisi (Georgia): International Symposium on Current and Potential Uses of Nut Trees in the EU. Info: Dr. Zviad Bobokashvili, Georgian Res. Inst. of Fruit and Vine Crop Germplasm Inv., Gelovani Street #6, Tbilisi 0115, Georgia. Phone: (995)93335793, E-mail: bobokashvili@hotmail.com or Dr. Irakli Zviadadze, Intern. Res. Inst. of果树GA, Tbilisi 41, Tbilisi, Georgia. Phone: (995)172254576, E-mail: mmarghania@hotmail.com
Web: http://www.nutssymposium2008.ge/

October 5-9, 2008, Mombasa (Kenya): International Conference Banana and Plantain in Africa. Harnessing International Partnerships to Increase Research Impact. Info: Thomas Dubois, IITA c/o Lambourn Ltd, Carolyn House, 26 Dingwall Road, Croydon CR9 3EE, United Kingdom. Phone: (256)75 2787808, Fax: (256)41 285079, E-mail: t.dubois@cgiar.org
Web: http://www.banana2008.com

October 14-17, 2008, Beijing (China): II International Symposium on Vegetable Production and Quality and Process Standardization in Chain: a Worldwide Perspective. Info: Dr. Wei Liu, Beijing Vegetable Research Center, Quality Control, PO Box 2443, Beijing 100097, China. Phone: (86)1051503003, Fax: (86)1088446286, E-mail: liwei@nervo.com or Prof. Dr. Silvana Nicolli, Dipartimento di Agronomia, Selvicultura e Gestione del Territorio, Via Leonardo Da Vinci 44, 10095 Grugliasco (TO), Italy. Phone: (39)0112368773, E-mail: silvana.nicolli@unito.it

October 20-24, 2008, Tucson, AZ (United States of America): International Workshop on Greenhouse Environmental Control and Crop Production in Semi-Arid Regions. Info: Prof. Dr. Gene A. Giacomelli, University of Arizona, Controlled Environment Agric. Ctr., CEA Building, 1951 E. Roger Road, Tucson, AZ 85719, United States of America. Phone: (1)5206269566, Fax: (1)5206261700, E-mail: giacomelli@ag.arizona.edu
Web: http://www.gghworkshoparidregions2008.org/

October 22-24, 2008, Sevilla (Spain): VII International Workshop on Sap Flow. Info: Dr. José Enrique Fernandez, Inst. de Rec. Nat.y Agrobiol., Campus de Reina Mercedes, Apartado 1052, 41080 Sevilla, Spain. Phone: (34)954624711, Fax: (34)954624002, E-mail: jefer@irnase.csic.es
Web: http://www.7iwsapflow.com/
NEW

October 28, 2008, Brussels (Belgium): ISAFRUIT Forum: Increasing Fruit Consumption to Improve Health. Info: Dr. Sharon Hall, Warwick HRI, University of Warwick, Wellesbourne, CV35 9EF, Warwick, United Kingdom. Phone: (44)2476575254, Fax: (44)2476574500, E-mail: sharon.hall@warwick.ac.uk Web: http://www.isafruit.org

October 29-31, 2008, Geisenheim (Germany): Workshop on Berry Production in Changing Climate Conditions and Cultivation Systems. Info: Dr. Erik Krüger, Forschungsanstalt Geisenheim, Fachgebiet Obstbau, Von-Lade-Straße 1, 65366 Geisenheim, Germany. Phone: (49)6722502561, Fax: (49) 6722502560, E-mail: krueger@gf-fg.de or Dr. Christoph Carlen, Res.Stat.Agroscope Changins, Wädenswil ACW, Centre des Fougères, 1964 Conthey, Switzerland. Phone: (41)27 345 35 11, Fax: (41) 27 346 30 17, E-mail: christoph.carlen@acw.admin.ch or Prof. Dr. Bruno Mezzetti, Dip.di Scienze Amb. e delle Prod.Veg., Università Politecnica delle Marche, Via Brecce Bianche, Ancona 60100, Italy. Phone: (39)07121204933, Fax: (39)0712204858, E-mail: b.mezzetti@unipmn.it E-mail symposium: krueger@gf-fg.de Web: http://www.costb365climatechange.de/

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 Web: http://www.ifihs2008.info/

November 4-7, 2008, Berlin (Germany): Postharvest Unlimited 2008. Info: Dr. Martin Geyer, Inst. für Agrartechnik Bornim, Abteilung Technik im Gartenbau, Max-Enzy-Allee 100, 14469 Potsdam-Bornim, Germany. Phone: (49)33156996610, Fax: (49)3315699849, E-mail: geyer@atb-potsdam.de Web: http://www.atb-potsdam.de/postharvest08

November 8-13, 2008, Firenze, Faenza and Caserta (Italy): IV International Symposium on Persimmon. Info: Prof. Dr. Elvio Bellini, University of Firenze, Horticultural Department, Viale delle idee 30, 50019 Sesto Fiorentino, Italy. Phone: (39)0554574053, Fax: (39)0554574017, E-mail: elvio.bellini@unifi.it or Dr. Edgardo Giordani, Department of Horticulture, University of Florence, Viale delle idee 30, 50019 Sesto Fiorentino (FI), Italy. Phone: (39) 55 4574050, Fax: (39)55 4574017, E-mail: edgardo.giordani@unifi.it Web: http://www.4persimmon2008.it

November 9-14, 2008, Cape Town (South Africa): WOCMAP IV: World Congress on Medicinal and Aromatic Plants. Info: Prof. Dr. Kobus J.N. Eloff, Phytomedicine Programme, University of Pretoria, Private Bag X04, 0002 Pretoria, South Africa. Phone: (27)12 5298244, Fax: (27)12 5298525, E-mail: kobus.eloff@up.ac.za E-mail symposium: wocmap@up.ac.za Web: http://www.wocmap2008.com/

November 10-13, 2008, Mérida (Mexico): II International Symposium on Guava and other Myrtaceae. Info: Dr. Wolfgang Rohde, MPtZ, Calf-von-Linne-Weg 10, 50829 Koeln, Germany. Phone: (49)2215062101, Fax: (49)2215062113, E-mail: rohde@mpiz-koeln.mpg.de or Dr. José 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 Web: http://www.cicy.mx/eventos/guavasympo2008/nn

December 7-11, 2008, Chiang Mai (Thailand): XVI International Symposium on Horticultural Economics and Management. Info: Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61) 9266 7596, Fax: (61)9266 3063, E-mail: p.batt@curtin.edu.au or Prof. Dr. Peter P Oppehenn, Deakin Business School, Deakin University, 336 Glenferrie Road, Malvern, VIC 3144, Australia. Phone: (61)3 9244 5549, Fax: (61)3 9244 5040 Web: http://www.muresk.curtin.edu.au/conference/shsem

December 7-11, 2008, Chiang Mai (Thailand): V International Symposium on Horticultural Research, Training and Extension. Info: Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)9266 7596, Fax: (61)9266 3063, E-mail: p.batt@curtin.edu.au or Associate Professor Dr. David Aldous, University of Melbourne, Burnley College, Swan Street, Richmond VIC 3121, Australia. Phone: (61)0392506880, Fax: (61)0392506885 Web: http://www.muresk.curtin.edu.au/conference/shsem

December 8-12, 2008, Bangalore (India): IV International Symposium on Acclimatization and Establishment of Micropropagated Plants. Info: Dr. Jitendra Prakash, In Vitro International Pvt. Ltd., #1244, Rajiv Gandhi Nagar, Bommanahalli, Bangalore 560 068, India. Phone: (91) 80 25727030, Fax: (91)80 25727030, E-mail: invitro@gl.vsnl.net.in Web: http://www.int-tissuecultureconf.org/

December 9-12, 2008, Madurai, Tamil Nadu (India): II International Symposium on Papaya. Info: Dr. N. Kumar, Department of Fruit Crops, Horticultural College & Research Institute, Piyakulam, 625 604, India. Phone: (91)4546231726, Fax: (91)4546231726, E-mail: kumarhott@yahoo.com Web: http://www.ishs-papaya2008.com/

YEAR 2009

January 28 - February 1, 2009, Dharwad (Karnataka State) (India): II International Symposium on Pomegranate and Minor, including Mediterranean, Fruits. Info: Dr. Jagdish Hanamant Kulkarni, University of Agricultural Sciences, UAS, Dharwad 580 005, Karnataka, India. Phone: (91)8362447783, Fax: (91)8362448349, E-mail: jhkulkarni@yahoo.co.in or Dr. Mohammed Kaiser Sheikh, College of Agriculture, Department of Horticulture, Bijapur 586 104, Karnataka, India. Phone: (91)8352267378, Fax: (91)8352267378, E-mail: dr_mksheikh@yahoo.co.in Web: http://www.uasdo.pomegranatesymposium

February 25-27, 2009, Melbourne (Australia): VI International Walnut Symposium. Info: Mr. Bryan Goble, Walnut Producer, 222 Karing-Koondrook Rd, Koondrook, VIC 3580, Australia. E-mail: btgoble@westnet.com.au or Dr. Leigh Timms, PO Box 417, Devonport, TAS 7310, Australia. Phone: (61)364283539, E-mail: leigh.timms@websterld.com.au Web: http://www.walnut.net.au/symposium_2009.htm

March 26-28, 2009, Jerba (Tunisia): International Symposium on Medicinal and Aromatic Plants SIPAM2009. Info: Dr. Mohamed Neffati, Institut des Regions Arides (IRA), 4119 Medenine, Tunisia. Phone: (216)75633839, Fax: (216)75633006, E-mail: neffati.mohamed@ira.rnt.tn

April 4-7, 2009, Antalya (Turkey): X International Controlled and Modified Atmosphere Research Conference. Info: Dr. Mustafa Erkan, Dep. of Horticulture, Fac. of Agric. Akdeniz Univ., 07058 Antalya, Turkey. Phone: (90) 242 3102428, Fax: (90) 242 2274564, E-mail: erkan@akdeniz.edu.tr Web: http://www.cama2009.com/

April 5-8, 2009, Leuven (Belgium): I International Symposium on Cryopreservation in Horticultural Species. Info: Dr. Bart Panis, Kasteelpark Aabenberg 13, 3001 Leuven, Belgium. Phone: (32)(16)-321690, Fax: (32)(16)-321993, E-mail: bart.panis@biw.kuleuven.be or Prof. Roy Swennen, Lab. Tropicale Plantenteelt, Kasteelpark Arenberg 13, 3001 Leuven, Belgium. Phone: (32)16-321993, E-mail: invitro@gl.vsnl.net.in Web: http://www.muresk.curtin.edu.au/conference/shsem

April 8-12, 2009, Antalya (Turkey): VI International Postharvest Symposium. Info: Dr. Mustafa Erkan, Dep. of Horticulture, Fac. of Agric. Akdeniz Univ., 07058 Antalya, Turkey. Phone: (90) 242...
July 29 - August 1, 2009, Corvallis, Oregon (United States of America): International Symposium on Molecular Markers in Horticultural Species. Info: Dr. Nahla V. Bassil, Plant Geneticist, National Clonal Germplasm Repository, 33447 Peoria Road, Corvallis, OR 97331-2352, United States of America. Phone: (541)7384214, Fax: (541)7384205, E-mail: nahla.bassil@ars.usda.gov E-mail symposium: conferences@oregonstate.edu Web: http://oregonstate.edu/conferences/molecularmarkers2009/

August 31 - September 4, 2009, Wageningen (Netherlands): XXIII Eucarpia Symposium on Ornamentals - Colorful Breeding and Genetics. Info: Dr. J.M. Van Tuyl, Plantbreeding, Wageningen University & Research Center. Dreevaandalse steeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317477329, Fax: (31)317418094, E-mail: jaap.vantuyl@wur.nl Web: http://www.ornamentalbreeding.nl/

September 8-11, 2009, Banks (Sweden): The International Rose Hip Conference. Info: Prof. Hilde Nyborg, Banks-Dept. Crop Studies, Swedish Univ. of Agricultural Sci., Box 7215, S-291 94 Kristianstad, Sweden. Phone: (46)44265802, Fax: (46)44265830, E-mail: hilde.nyborg@ltj.slu.se

September 14-18, 2009, Guangzhou, Guangdong (China): International ISHS-ProMusa Symposium: Global Perspectives on Asian Challenges. Info: Dr. Prof. G. Van Tuyl, Plantbreeding, Wageningen University & Research Center. Dreevaandalse steeg 1, 6708 PB Wageningen, Netherlands. Phone: (31)317477329, Fax: (31)317418094, E-mail: jaap.vantuyl@wur.nl Web: http://www.ornamentalbreeding.nl/

September 20-24, 2009, Bologna (Italy): XI International Symposium on Plant Bioregulators in Fruit Production. Info: Prof. Guglielmo Costa, Ordinario di Arboricoltura Generale, Dipartimento di Colture Arboree, Università degli Studi di Bologna, Via G. Fanin 46, 40127 Bologna, Italy. Phone: (39)051 20 9 6443, Fax: (39)051 20 9 6401, E-mail: guglielmo.costa@unibo.it Web: http://www.greenys2009.com

September 21-26, 2009, Changsha, Hunan (China): IV International Cucurbit Symposium. Info: Prof. Xiaowu Sun, Dr. Inge Van den Bergh, Bioversity International, 1990 Boulevard de la Lironde, Parc Scientifique Agropolis II, 34397 Montpellier, France. Phone: (33)4-67613034, E-mail: i.vandenbergh@cgiar.org Web: http://www.cucurbit2009.org

September 29 - October 3, 2009, Meknes (Morocco): IV International Symposium on Fig. Info: Prof. Dr. Messaoudi Zerhourne, Dept. Arboriculture-Viticulture, Ecole Nationale d'Agriculture de Meknes, B.P. S/40, 50000 Meknes, Morocco. Phone: (212)61353653, Fax: (212)61353023, E-mail: messaoudiz@yahoo.fr

October 4-7, 2009, London (United Kingdom): International Symposium on Plants for People and Places – Valuing Plants and Human Welfare. Info: Erin Taylor, Group Development Manager, SCI – International Headquarters, 14-15 Belgrave Square, London, SW1X 8PS, United Kingdom. Phone: (44)2075981594, Fax: (44)2075981545, E-mail: erin.taylor@soci.org Web: www.soci.org/events

October 13-17, 2009, Sanliurfa (Turkey): V International Symposium on Pistachios and Almonds. Info: Prof. Dr. Bekir Erol Ak, Harran University, Faculty of Agriculture, 63200 Sanliurfa, Turkey. Phone: (90)4142470384 2319, Fax: (90)4142470384, E-mail: beak@harran.edu.tr

October 14-16, 2009, Cuneo (Italy): I European Congress on Chestnut - Castanea 2009. Info: Prof. Dr. Giancarlo Bounous, Dipartimento di Colture Arboree, Università degli studi di Torino, Via Leonardo da Vinci 44, 10095 Grugliasco, TO, Italy. Phone: (39)0116708653, Fax: (39)0116708655, E-mail: giancarlo.bounous@unito.it Web: http://www.arboreo.unito.it/castanea2009

http://oregonstate.edu/conferences/molecularmarkers2009/
October 18-21, 2009, Murcia (Spain): V International Symposium on Seed, Transplant and Stand Establishment. Info: Dr. Francisco Perez-Alfocea, Dept. Of Irrigation and Salinity, CEBAS-CSIC, PO Box 4195, 30080 Murcia, Spain. Phone: (34)968396200, Fax: (34)968396213, E-mail: alfocea@cebas.csic.es or Dr. Jose A. Pascual Valero, CEBAS-CSIS, Campus Univ. De Espinardo s/n, 30100 Murcia, Spain. Phone: (34)968396200, Fax: (34)968396213.

October 27-29, 2009, Nasser City, Cairo (Egypt): XIII International Conference and Exhibition: Medicinal and Aromatic Plants - Challenges and Opportunities. Info: Info: Prof. Dr. Issam Abdel-Galil, Desert Research Center, 1, Mothaf El-Mataria, Cairo, Egypt. Phone: (20)2223674800 or 26332846, Fax: (20)2223675858, E-mail: ismail@brainy1.ie-eg.com or Dr. Farouk El-Shobaki, ESMAP, 6, Dr. Farouk El-Shobaki Street, El-Koum El-Akhdon, Pyramids, Giza, Egypt. Phone: (20)223369896, Fax: (20)2233841120, E-mail: drfarouk@elsobaki.com.

November 2-6, 2009, Viña del Mar (Chile): VI International Symposium on Irrigation of Horticultural Crops. Info: Dr. Samuel Ortega-Farias, Casilla 747, Talca, Chile. Phone: (56)71200214, Fax: (56)71200214, E-mail: sorgentef@utalca.cl or Gabriel Selles, Inst. De Invest. Agro., Santa Rosa 11610, Santiago, Chile. Phone: (56)27575105, E-mail: gsesellenia.cl or Nelson Pereira Muñoz, National Irrigation Commission, Alameda B. O’Higgins 1449, Piso 4º, Santiago, Chile. Phone: (56)2420529014, E-mail: nelson.pereira@cnr.gob.cl.

November 15-19, 2009, Tsukuba (Japan): VI International Symposium on Light in Horticulture.  Info: Eiji Goto, Chiba University, 648 Matsudo, Chiba 271-8510, Japan. Phone: (81)47-308-8841, Fax: (81)47-308-8842, E-mail: goto@faculty.chiba-u.jp. E-mail symposium: info@lightsym2009.jp Web: http://www.lightsym2009.jp.

November 15-20, 2009, Santiago (Chile): VI International Cherry Symposium. Info: Dr. Marlene Ayala, Departamento de Fruticultura y Enología, Facultad de Agronomía e Ingeniería Forestal, Casilla 306 Correo 22, Santiago, Chile. Phone: (56)6864159, Fax: (56)5534130, E-mail: mayalaz@uc.cl or Prof. Juan Pablo Zoffoli, Av Vicuna Mackenna 4860, Dept. Fruticultura y Enología, Santiago 30622, Chile. Phone: (56)266 4159, Fax: (56)262 554130, E-mail: zoffoli@uc.cl.

November 25-27, 2009, New Delhi (India): II International Symposium on Medicinal and Nutraceutical Plants Info: Dr. Sushil Chandra Mahapatra, All India Institute for Medical Education, Nutrition&Phytonmed. Lab. - Dept. Physiology, Ansari Nagar, New Delhi 110 608, India. Phone: (91)11 26594812, Fax: (91)11 26588641, E-mail: scmahapatra@gmail.com.

November 30 - December 4, 2009, Campinas (Brazil): International Symposium on Genetic Research of Bamboos and Palms. Info: Dr. Antonio Fernando Tombolato, Instituto Agronomico, Avenida Barão de Ipatra 1481, Caixa Postal 28, 13012-970 Campinas SP, Brazil. Phone: (55)1932415188, Fax: (55)1932415750, Email: tombolato@iac.sp.gov.br or Prof. Kathia J Costa, Lab. de Biologia Florestal, Km 5, Departamento de Horticultura, 14870-000 Jaboticabal, Brazil. Phone: (55)16322500, Fax: (55)163224275, Email: kathia@fcav.unesp.br.

YEAR 2010

January 12-15, 2010, Taichung (Taiwan): I International Orchid Symposium. Info: Dr. Yung-I Lee, Botany Department, National Museum of Natural Science, NO 1, Kuan-Chien Rd., Taichung 404, Taiwan. Phone: (886)-4-23226940-153, Fax: (886)-4-23285320, E-mail: leeyung@hotmail.com or Assist. Prof. Erik Runkle, A240-C Plant & Soil Sci. Bldg., Michigan State University, East Lansing, MI 48824, United States of America. Phone: (1)517.355.5191 x350, Fax: (1)517.353.0890, E-mail: runkler@msu.edu.

May 3-6, 2010, Antakya-Hatay (Turkey): III International Symposium on Loquat. Info: Prof. Dr. A. Aytekim Polat, Mustafa Kemal University, Faculty of Agriculture, Dept. of Horticulture, Antakya Hatay, 31034, Turkey. Phone: (90)6232455605, Fax: (90)3262455832, E-mail: apolat@mku.edu.tr.

July 25-30, 2010, Ischia (NA) (Italy): XIII International Symposium on Tomato Diseases. Info: Dr. Fabio Beccatini, Dip.di Biol, Difesa e Biotech Agro-Forestale, Fac. di Agraria, University of Basilicata, Via dell’At. Lucano 10, LOTTO 3a, STANZA 310, 85100 Potenza (Potenza), Italy. Phone: (39)0971205700, Fax: (39)0971205703, E-mail: anielo.crescenzi@units.it.

August 1-5, 2010, Geneva, NY (United States of America): X International Conference on Grapevine Breeding and Genetics. Info: Bruce Reisch, NY State Agric. Exp. Station, 630 W. North Street, Geneva, NY 14456, United States of America. Phone: (1)3157872239, Fax: (1)3157872216, E-mail: birl@cornell.edu.

August 15-19, 2010, Warsaw (Poland): XII International Workshop on Fire Blight. Info: Dr. Piotr Sobczewicz, Res. Inst. of Pomology, Ul. Pomologiczna 18, 96-100 Skieriniewice, Poland. Phone: (48)46 8332021, Fax: (48)46 8333228, E-mail: psobicz@insad.pl.

August 19, 2010, Lisbon (Portugal): Meeting of the ISHS Executive Committee.


August 22-27, 2010, Lisbon (Portugal): XXVIII International Horticultural Congress - IHIC2010. Info: Prof. Dr. António A. Monteiro, Instituto Superior de Agronomia, Technical University of Lisbon, Tapada da Ajuda, 1349-017 Lisbon, Portugal. Phone: (351)213653451, Fax: (351)21362262, E-mail: amonteiro@isa.utl.pt or Dr. Victor Galan Saúco, Inst. Canario de Inv. Agrar., I.C.I.A., Apartado 60, 38200 La Laguna, Tenerife, Spain. Phone: (34)922476321, Fax: (34)922476303, E-mail: vgalan@icia.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org.

August 30 - September 3, 2010, Pescia (PT) - Tuscany (Italy): II International Symposium on the Genus Lilium. Info: Dr. Antonio Grassotti, CRA-IVV, Via dei Fion 8, 51012 Pescia (PT), Italy. Phone: (39)0572451033, Fax: (39)0572453309, E-mail: antonio.grassotti@entecria.it.

September 15-30, 2010, Faenza (Italy): VII International Symposium on Kiwifruit. Info: Prof. Guglielmo Costa, Ordinario di Arboricoltura Generale, Dipartimento di Coltura Arborea, Via G. Fanin 46, 40127 Bologna, Italy. Phone: (39)051 20 9 6443, Fax: (39)051 20 9 6401, E-mail: guglielmo.costa@unibo.it.

September 20-21, 2010, Vienna (Austria): V International Phyloxera Symposium. Info: Prof. Dr. Astrid Forneck and Dr. Michaela Grieser, University of Natural Resources and Applied Life Sciences, Department of Applied Plant Sciences and Plant Biotechnology, Institute of Horticulture and Viticulture, Peter Jordan Str. 82, A-1190 Vienna, Austria. Phone: (43)1476543441, Fax: (43)1476543359, E-mail: astrid.foeneck@boku.ac.at and michaela.grieser@boku.ac.at.
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<table>
<thead>
<tr>
<th>Acta Number</th>
<th>Acta Title</th>
<th>Acta Title Acta</th>
<th>Acta Price (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>795</td>
<td>V International Cherry Symposium</td>
<td>Acta Horticul...</td>
<td>197</td>
</tr>
<tr>
<td>794</td>
<td>II International Symposium on Improving the Performance of Supply Chains in the Transitional Economies</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>793</td>
<td>XI International Workshop on Fire Blight</td>
<td></td>
<td>116</td>
</tr>
<tr>
<td>792</td>
<td>V International Symposium on Irrigation of Horticultural Crops</td>
<td></td>
<td>146</td>
</tr>
<tr>
<td>791</td>
<td>V International Symposium on Olive Growing</td>
<td></td>
<td>157</td>
</tr>
<tr>
<td>790</td>
<td>VIII International People-Plant Symposium on Exploring Therapeutic Powers of Flowers, Greenery and Nature</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>789</td>
<td>XV Meeting of the EUCARPIA Tomato Working Group</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>788</td>
<td>International Workshop on Ornamental Plants</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>787</td>
<td>International Workshop on Tropical and Subtropical Fruits</td>
<td></td>
<td>93</td>
</tr>
<tr>
<td>786</td>
<td>International Workshop on Medicinal and Aromatic Plants</td>
<td></td>
<td>76</td>
</tr>
<tr>
<td>785</td>
<td>International Symposium on Grape Production and Processing</td>
<td></td>
<td>112</td>
</tr>
<tr>
<td>784</td>
<td>I I I I International Congress on Chestnut</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>783</td>
<td>II International Conference on Turfgrass Science and Management for Sports Fields</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>782</td>
<td>IV International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops; Translating Seed and Seedling Physiology into Technology</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>781</td>
<td>XX International Symposium on Virus and Virus-Like Diseases of Temperate Fruit Crops - Fruit Tree Diseases</td>
<td></td>
<td>119</td>
</tr>
<tr>
<td>780</td>
<td>XI International Symposium on Small Fruit Virus Diseases</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>779</td>
<td>International Symposium on Growing Media</td>
<td></td>
<td>146</td>
</tr>
<tr>
<td>778</td>
<td>II International Symposium on Natural Preservatives in Food, Feed, and Cosmetics</td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>777</td>
<td>IX International Rubus and Ribes Symposium</td>
<td></td>
<td>115</td>
</tr>
<tr>
<td>776</td>
<td>XI International Asparagus Symposium</td>
<td></td>
<td>110</td>
</tr>
<tr>
<td>772</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Enhancing Economic and Environmental Sustainability of Fruit Production in a Global Economy</td>
<td></td>
<td>112</td>
</tr>
<tr>
<td>771</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Seed Enhancement and Seedling Production Technology</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>770</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Cultivation and Utilization of Asian, Sub-tropical, and Underutilized Horticultural Crops</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>769</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Asian Plants with Unique Horticultural Potential</td>
<td></td>
<td>112</td>
</tr>
<tr>
<td>768</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on The Role of Postharvest Technology in the Globalisation of Horticulture</td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>767</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Sustainability through Integrated and Organic Horticulture</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>765</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Plants as Food and Medicine: The Utilization and Development of Horticultural Plants for Human Health</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>763</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Structural and Functional Genomics of Horticultural Plants</td>
<td></td>
<td>79</td>
</tr>
<tr>
<td>762</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Horticultural Plants in Urban and Peri-Urban Life</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>761</td>
<td>XXVII International Horticultural Congress - IHC2006: International Symposium on Advances in Environmental Control, Automation and Cultivation Systems for Sustainable, High-Quality Crop Production under Protected Cultivation</td>
<td></td>
<td>134</td>
</tr>
<tr>
<td>760</td>
<td>XXVII International Horticultural Congress - IHC2006: II International Symposium on Plant Genetic Resources of Horticultural Crops</td>
<td></td>
<td>141</td>
</tr>
<tr>
<td>759</td>
<td>XXVII International Horticultural Congress - IHC2006: Global Horticulture: Diversity and Harmony, an Introduction to IHC2006</td>
<td></td>
<td>59</td>
</tr>
<tr>
<td>758</td>
<td>X International Symposium on the Processing Tomato</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>754</td>
<td>International Workshop on Advances in Grapevine and Wine Research</td>
<td></td>
<td>119</td>
</tr>
<tr>
<td>752</td>
<td>I International Conference on Indigenous Vegetables and Legumes. Prospectus for Fighting Poverty, Hunger and Malnutrition</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>751</td>
<td>IV International Symposium on Rose Research and Cultivation</td>
<td></td>
<td>108</td>
</tr>
<tr>
<td>750</td>
<td>II International Symposium on Loquat</td>
<td></td>
<td>107</td>
</tr>
<tr>
<td>747</td>
<td>VIII International Symposium on Protected Cultivation in Mild Winter Climates: Advances in Soil and Soilless Cultivation under Protected Environment</td>
<td></td>
<td>123</td>
</tr>
<tr>
<td>745</td>
<td>VI International Solanaceae Conference: Genomics Meets Biodiversity</td>
<td></td>
<td>119</td>
</tr>
<tr>
<td>744</td>
<td>I International Symposium on Human Health Effects of Fruits and Vegetables</td>
<td></td>
<td>103</td>
</tr>
<tr>
<td>743</td>
<td>XXII International Eucarpia Symposium, Section Ornamentals, Breeding for Beauty - Part II</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>742</td>
<td>International Conference and Exhibition on Soilless Culture: ICESC 2005</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>740</td>
<td>I International Symposium on Papaya</td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>736</td>
<td>III International Date Palm Conference</td>
<td></td>
<td>124</td>
</tr>
<tr>
<td>735</td>
<td>I International Guava Symposium</td>
<td></td>
<td>138</td>
</tr>
</tbody>
</table>
III International Grapevine Phylloxera Symposium 52
III Balkan Symposium on Vegetables and Potatoes 104
V International Congress on Cactus Pear and Cochineal 75
IV International Symposium on Pistachios and Almonds 146
IX International Symposium on the Processing Tomato 82
XIII International Symposium on Apricot Breeding and Culture 88
XXII International Eucarpia Symposium, Section Ornamentals, Breeding for Beauty 63
IV International Conference on Managing Quality in Chains - The Integrated View on Fruits and Vegetables Quality 188
II International Symposium on Sweetpotato and Cassava: Innovative Technologies for Commercialization 69
V International Pineapple Symposium 60
VI International Symposium on Chemical and non-Chemical Soil and Substrate Disinfestation - SD2004 79
IX International Symposium on Protected Cultivation in Tropical and Subtropical Species 54
International Conference Postharvest Unlimited Downunder 2004 89
III International Symposium on Applications of Modelling as an Innovative Technology in the Agri-Food Chain; MODEL-IT 121
IX International Symposium on Flower Bulbs 150
IX International Pear Symposium 124
I International Conference on Turfgrass Management and Science for Sports Fields 115
VII International Symposium on Protected Cultivation in Mild Winter Climates: Production, Pest Management and Global Competition 159
I International Symposium on Rootstocks for Deciduous Fruit Tree Species 137
XIX International Symposium on Virus and Virus-like Diseases of Temperate Fruit Crops - Fruit Tree Diseases 117
X International Symposium on Small Fruit Virus Diseases 57
XV International Symposium on Horticultural Economics and Management 106
International Workshop on Models for Plant Growth and Control of Product Quality in Horticultural Production 77
IX International Symposium on Plant Bioregulators in Fruit Production 61
I International Symposium on Grapevine Growing, Commerce and Research 108
XXI International Eucarpia Symposium on Classical versus Molecular Breeding of Ornamentals - Part II 54
Euro Berry Symposium - Cost B36 Final Workshop 77
South Pacific Soilless Culture Conference - SPSCC 60
International Code of Nomenclature for Cultivated Plants - Code International pour la Nomenclature des Plantes Cultivées 55
International Symposium on Growing Media and Hydroponics 117
XXVI International Horticultural Congress: Horticulture, Art and Science for Life - The Colloquia Presentations 60
XXVI International Horticultural Congress: The Knowledge Business: Horticulture Education and Knowledge Transfer 51
XXVI International Horticultural Congress: Viticulture - Living with Limitations 86
XXVI International Horticultural Congress: Expanding Roles for Horticulture in Improving Human Well-Being and Life Quality 84
XXVI International Horticultural Congress: Sustainability of Horticultural Systems in the 21st Century 105
XXVI International Horticultural Congress: Advances in Vegetable Breeding 84
XXVI International Horticultural Congress: Key Processes in the Growth and Cropping of Deciduous Fruit and Nut Trees 140
XXVI International Horticultural Congress: Managing Soil-Borne Pathogens: A Sound Rhizosphere to Improve Productivity in Intensive Horticultural Systems 57
XXVI International Horticultural Congress: IV International Symposium on Taxonomy of Cultivated Plants 68
XXVI International Horticultural Congress: Protected Cultivation 2002: In Search of Structures, Systems and Plant Materials for Sustainable Greenhouse Production 109
XXVI International Horticultural Congress: Citrus and Other Subtropical and Tropical Fruit Crops: Issues, Advances and Opportunities 81
XXVI International Horticultural Congress: Issues and Advances in Transplant Production and Stand Establishment Research 70
XXVI International Horticultural Congress: Nursery Crops; Development, Evaluation, Production and Use 78
XXVI International Horticultural Congress: The Future for Medicinal and Aromatic Plants 107
XXVI International Horticultural Congress: Issues and Advances in Postharvest Horticulture 168
XXVI International Horticultural Congress: Toward Ecologically Sound Fertilization Strategies for Field Vegetable Production 71
XXVI International Horticultural Congress: Berry Crop Breeding, Production and Utilization for a New Century 96
XXVI International Horticultural Congress: Biotechnology in Horticultural Crop Improvement: Achievements, Opportunities and Limitations 98
XXVI International Horticultural Congress: Elegant Science in Floriculture 110
XXVI International Horticultural Congress: Horticultural Science in Emerging Economies, Issues and Constraints 46
XXVI International Horticultural Congress: Potatoes, Healthy Food for Humanity: International Developments in Breeding, Production, Protection and Utilization 99
XXVI International Horticultural Congress: Environmental Stress and Horticulture Crops 107

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Valuing Plants and Human Welfare

Sunday 4 - Wednesday 7 October 2009
The Royal Society, London, UK

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Plants for People and Places
Valuing Plants and Human Welfare
Sunday 4 - Wednesday 7 October 2009, The Royal Society, London, UK

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This symposium will provide a forum to discuss and analyse the role of plants as vehicles for improving mental and psychological health and well-being. This forum will consider how medical practice, businesses and recreational areas can benefit from the value of plants for people. Extending and enhancing human life with resultant diminished demand for health and welfare services is a key issue to be drawn on by the Symposium.

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Conference
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Tuesday 6 October 2009
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