Chronica Horticulturae

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IHC
Lisboa 2010

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ISHS

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CHRONICA HORTICULTURAE

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All major Credit Cards accepted. Always quote your name and invoice or membership number. Make checks payable to ISHS Secretariat. Money transfers: ISHS main bank account number is 230-0019444-64. Bank details: Fortis Bank, Branch "Heverlee Arenberg", Naamsesteenweg 173/175, B-3001 Leuven 1, Belgium. BIC (SWIFT code): GEBABEBB08A, IBAN: BE29230001944464. Please arrange for all bank costs to be taken from your account assuring that ISHS receives the net amount. Prices listed are in euro (EUR) but ISHS accepts payments in USD as well.

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

The Journal of Horticultural Science & Biotechnology (JHSB)

The JHSB, a "partner" refereed research Journal of the ISHS, is a leading peer reviewed, citation-rated Journal of international stature, reputation and eminence. It publishes high-quality original research findings in horticultural science and biotechnology to a world-wide audience. JHSB is an English Charity owned by its Trustees for the benefit of horticultural science and society-at-large, on a not-for-profit basis. Available online at **www.pubhort.org**

The ISHS has a number of collaboration agreements with other Journals. Additional information can be seen from the PubHort website.

Cover photograph: Fuchsia, ornamental plant indigenous to the Americas. Photo courtesy of Michael N. Dana. See p. 22.

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

ISHS

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The Road to a Stronger and More Influential ISHS

Norman E. Looney, ISHS President

Norman E. Looney

In early 2006 the ISHS Board met with a professional facilitator to review past progress, consider the Society's mission statement, and develop an ambitious strategic plan (see "An Exercise in Strategic Planning" in *Chronica Horticulturae* 46(3):3-4). The outcomes of that exercise have guided the efforts of the present Board to expand the scope and influence of the Society with strategic partnerships and to advocate for our profession in more imaginative ways. We aimed to represent more of our colleagues by increasing Individual Members, but also by increasing Country/Region Members; the latter being very important since it was recognized that at that time about 14% of our individual members lived in countries not represented on the ISHS governing Council.

The strategic plan also articulated a vision of stronger Science Sections and Commissions with chairs and vice chairs selected through formally organized elections, and with a program of work addressing the full range of horticultural crops and disciplines. It called for continuing improvements in the quality and range of Society publications, and continued expansion and development of an online portal, now called PubHort, which would better serve the broader knowledge and information needs of horticultural science and industry worldwide. Finally, the plan provided guidance to the efforts of the President and Board to connect ISHS to other international efforts to apply horticultural science and industry to the task of reducing poverty and malnutrition in the world's poorest regions. It was an ambitious plan but deemed to be fully achievable.

In August of this year ISHS will celebrate its 28th International Horticultural Congress after which a newly elected President and Board will manage Society affairs. Thus, I have chosen to use this opportunity to call attention to some of what was achieved over the past four years, focusing on how ISHS has been strengthened through strategic partnerships and membership growth. I am very proud of the fact that the new Board will lead a Society that is substantially stronger, more democratic, and more influential than was the case only four years earlier.

STRENGTH THROUGH PARTNERING

The range of topics addressed at the International Horticultural Congress and at the hundreds of ISHS symposia and conferences in recent years demonstrates how horticultural science can be examined and advanced in so many different ways. Collectively, our members represent and the ISHS science program reflects a huge diversity of interests. This is in part due to the fact that horticultural industry utilizes hundreds of plant species and many thousands of improved cultivars, with new crops being developed every year. Each species and crop presents unique problems and opportunities that can be considered from many perspectives. Our efforts range from the most fundamental to the highly practical, from molecular genetics to whole plant physiology, from crop management to work on the socioeconomic front of horticultural science and industry.

It is not surprising then that many horticultural scientists sustain membership in several professional societies and many more participate occasionally in conferences that address interests underserved by ISHS or by a national or regional society for horticultural science.

Consider for example the International Plant Propagator's Society (IPPS). It focuses on the interests and needs of the nursery trades but attracts a loyal cadre of horticultural scientists whose work largely serves that industry. Interestingly, while plant propagation is a 'core' subject in horticultural science programs at colleges and universities, it has seldom been the focus of an international symposium organized by ISHS. The result is that visitors to the archives of *Acta Horticulturae* (now over 25,000 hits per day!) are unable to find the wealth of information about plant propagation many expect.

By partnering with IPPS, ISHS will soon provide visitors to www.pubhort.org access to the full library of the proceedings of IPPS meetings dating back many decades. The digitizing and archiving of these proceedings, containing important knowledge about plant propagation, is clearly beneficial to both societies. ISHS is celebrating and adding value to the contributions of close colleagues. It is gaining stature by demonstrating its capacity to serve diverse professional interests. Similar arrangements are in place with the American Pomological Society and the International Society of Mushroom Science. Others are on the horizon.

Our second approach to strengthening the Society through partnerships has been to invite another society serving a specific horticultural crop to have a seat on the ISHS Executive Committee, establish joint Working Groups, and co-organize international symposia in the complementary area of interest. Here the primary aim is to strengthen the ISHS science program. This was achieved with the International Society of Citriculture (ISC) and with the International Network for Improvement of Banana and Plantain (INIBAP), formerly hosted by the International Plant Genetic Resources Institute (IPGRI; now Bioversity International). ISHS now has a Section Citrus, a Section Banana and Plantain, and four new Working Groups. Other opportunities are being explored. For example, discussions are underway with the International Society of Mushroom Science with the aim of establishing a joint ISHS-ISMS Section Mushrooms.

BROADENING MEMBERSHIP AND PROVIDING NEW SERVICES

The 2006 strategic plan called for strengthening ISHS membership and membership services appropriate to Central and South America, a region historically under-represented in our Society. It also called for expanding the influence of the Society by offering management services to sister organizations. I am very pleased to report that these objectives have been achieved and exceeded on several fronts.

Gaining Members and Influence in Latin America

In 2006 only three Latin America countries, Brazil, Chile and Mexico, were represented on the Society governing Council. In 2010 there will be representatives from Argentina, Brazil, Chile, Columbia, Mexico, Peru and Venezuela at the Council table in Lisbon. We expect that there also will be representatives from the Caribbean Region where members from several island nations are at time of writing cooperating to gain a voice on Council. However, Costa Rica and Ecuador, both with strong contingents of Individual Members, are yet to be represented on Council. Clearly there is work left to do.

One major achievement in aid of ISHS gaining greater influence in Latin America is the 2008 Memorandum of Understanding with Embrapa, the Brazilian national agency for agricultural research and extension. It arose from a meeting with Embrapa senior management during the ISHS Board meeting at Florianopolis, Brazil, in 2007. It calls for ISHS providing full access to the ActaHort database to all of Embrapa's 2100 scientists and Embrapa agreeing to sponsor 'first time' ISHS membership for interested employees. The ISHS Secretariat also has contracted to provide a range of membership services to the Colombian Society for Horticultural Science and will soon post current and past issues of *Revista Colombiana de Ciencias Horticolas* on the PubHort portal.

Finally, we have progressed in meeting our goal of achieving a high level of cooperation and collegiality with the Interamerican Society for Tropical Horticulture (ISTH). In late 2009 the ISHS Executive Director and Antonio Monteiro, the Co-President of the Lisbon IHC, attended the annual meeting of ISTH in Barquisimeto, Venezuela. They met with ISTH leadership to determine how ISHS and ISTH can work together. Excellent progress was made toward coordinating and complementing activities to better serve tropical horticulture researchers in Latin America and around the world. To support these various initiatives the ISHS Secretariat is providing more services in Spanish and the Society has reaffirmed its readiness to accommodate symposium presentations and *Acta* papers in Spanish (providing that there is also an extended English abstract).

Strengthening the Society's Governing Council

It is heartening to see this progress toward gaining ISHS membership and involvement in Latin America but the Board is equally proud of the fact that good progress has been made in Eastern Europe, the Middle East, and Africa. In Eastern Europe we have gained Russia and Armenia as Country/Region Members. In the Middle East we can now count Oman and Saudi Arabia, and in Africa we have gained Kenya and Nigeria. Although we have lost Finland, Slovenia, and Macedonia as Country/Region members, hopefully this situation can be reversed.

Individual membership in the Society continues to expand. The final figures for 2009 show 7356 members from 146 countries. The comparable statistic four years earlier was 6156 members from 137 countries. Many new members are coming from developing countries and many of these countries are not yet represented on the ISHS Council. Still, over this time period by increasing the number of countries and regions that are represented on Council, the proportion of ISHS individual members living in a non-member country or region now stands at just 11%. Given that our more than 250 members in China remain unrepresented, every effort is being made to achieve country/region member status for that country before Council meets in Lisbon later this year. If successful this will reduce the proportion of individual members still unrepresented to 7.5%.

This trend represents a significant democratization of the Society during the tenure of this Board. Still, the effort to achieve a governing Council that fully reflects and represents the interests of each continent and region must continue to occupy the next Board.

Much more can be said about how our Society has been strengthened since 2005 by its ever expanding science program, its publications, and the management of society finances to ensure that it sustains a health reserve. With earlier communications in this space, Ian Warrington has reported on the steady increase in the number and quality of international symposia organized by members of our Sections and Commissions and Rob Bogers has kept members informed about Society financial management. They and other Board members have also contributed 'op-ed' pieces addressing issues relevant to the Society and our profession.

ISHS has achieved the status of being the strongest and most influential international science society serving plant agriculture. It has an efficient and highly respected Secretariat. Its Sections and Commissions, international symposia, and International Congresses now address the great majority of crops and disciplines of interest to horticultural science and industry. Its publications (*Acta Horticulturae, Scripta Horticultuae,* and *Chronica Horticulturae*) and web resources inform horticultural research and education around the world. It has displayed important leadership in engaging an international community of agricultural scientists in addressing the needs and opportunities for professional interventions in the developing world.

I am confident that with informed, committed and imaginative leadership ISHS will become ever stronger during the next four-year cycle. Thus, I would strongly second the words of our Vice President, Ian Warrington, urging members to reflect on what the Society needs by way of leadership and to engage in the process this year of renewing leadership of our Sections and Commissions. While it is the members of Council that elect the new Society President and Board of Directors, they are expected to entertain and respect the suggestions of their constituency.

Serving ISHS as President has been the high point of my lifelong work as a horticultural scientist. I have been exceedingly fortunate to work with an outstanding team of Board members and a Secretariat staff under the superb management of our Executive Director, Jozef Van Assche. It has been gratifying to observe the progress that can be achieved by a team that pulls together and remains faithful to a well-considered strategic plan. I highly recommend this approach to the next President and Board and wish them every success!

Amendments to the ISHS Statutes

In the past the ISHS Board received a couple of questions from members who did not understand what was meant by Country/State. Indeed, the distinction between country and state is not clear. Well-known English dictionaries (Oxford, Longman, Webster) all give similar descriptions of country and state, e.g., Merriam-Webster online:

Country: a political state or nation or its territory.
State: a politically organized body of people usually occupying a definite territory.
Region: a) an administrative area, division, or district;
b) a broad geographic area distinguished by similar features.

Therefore, to avoid misunderstanding, the Board proposes to change these words in the Statutes into 'Country and Region'. This will make it possible for a number of islands to join the ISHS as one 'Region' member. The amendments proposed are shown in red script.

In accordance with Article 15 of the Statutes, these revisions, agreed to by all members of the Board, will be presented to Council for further consideration when it meets in Lisbon on August 20 and 21, 2010. Those amendments accepted, and perhaps others proposed and accepted by Council at Lisbon, will then be submitted, with comments, for approval by the ISHS General Assembly when it meets on August 24, 2010 in Lisbon, Portugal.

INTERNATIONAL SOCIETY FOR HORTICULTURAL SCIENCE - STATUTES

Statutes as published August 10th, 2000 including Amendments of the ISHS Council of 2006 and published February 19th, 2008.

Presented with amendments (in red) in Articles 4.1., 4.2.2., 4.2.3., 4.4., 7.5., 8.1., 8.2., 8.6., 8.6.1., 9.6., 9.8., 16. as proposed by the ISHS Board autumn 2009.

TITLE I. Name, Registered Office and General Objectives

Article 1. NAME AND REGISTERED OFFICE

1.1. The Society is registered as a not-for-profit 'International Association' following the Belgian law of 27 June 1921 on the not-for-profit associations, on not-for-profit foundations and international associations.

The name of the Society in English is the "**International Society for Horticultural Science**", hereafter referred to as "the Society" or "**ISHS**", or in French "**Société Internationale de la Science Horticole**".

The official languages of the Society are English and French. In case of dispute, the French version of the Statutes is considered definitive.

1.2. The Society is established for an indefinite period of time.

1.3. The registered office of the Society is in 1083 Brussels, Rue du Serpolet 18, Belgium. The registered seat can be changed to wherever in the Brussels-Capital (Belgium) Region by simple decision of the Council, to be published within a period of one month, in the annexes of the Moniteur Belge.

Article 2. OBJECTIVE

2.1. The objective of the Society is: to further all sectors of horticulture by improving international cooperation in the scientific study, education and exchange of knowledge of biological, technical, ecological, environmental, sociological and economic issues as they affect horticulture.

Article 3. ACTIVITIES

The Society will:

3.1. hold International Congresses at regular intervals

3.2. arrange international workshops and symposia as well as other international meetings

3.3 establish Sections according to commodities within horticulture and Commissions according to subjects of horticultural science and technology that range across several commodity sectors

3.4. form relationships, and cooperate, with other governmental and non-governmental organizations in its field of interest

3.5. edit, produce and distribute information, reports and scientific or technical publications, reserving the exclusive rights and copyrights to the Society according to Belgian law

3.6. use other legal means to achieve the objectives of the Society.

TITLE II. Membership

Article 4. MEMBERS

4.1. Membership of the Society is open to individuals, institutions/organizations, countries and regions (the word 'states' is dropped), subscribing to the objectives of the Society. Organizations must be legally registered in accordance with the laws and customs of their country/region ('region' replaces the word 'state') of origin.

4.2. The Society recognizes the following main categories of members:

4.2.1. Individual members

4.2.2. Country/region members represented by ministries, national or regional societies, national or regional associations or institutes

4.2.3. Institutional members: any other organization with an interest in horticultural science and technology

4.2.4. Honorary members: individuals who, in the judgment of the Council, have made an exceptional contribution to the Society. They are appointed for life by the General Assembly.

4.3. Membership is available upon application to the Board and payment of the annual dues. Honorary Members are exempt from payment of annual dues.

4.4. The Secretariat maintains a register of all members listed by country/region.

4.5. The Board has the right to reject an application for membership and to terminate membership.

4.6. Membership ends in the event of:

4.6.1. resignation

4.6.2. death of the individual or dissolution of the organization (as defined in 4.2.3.)

4.6.3. termination of Society membership by a decision of the Board for non-compliance with the Statutes or Rules of Procedures.

4.7. The creditors or heirs of a member have, without exception, no claim on the goods or assets of the Society; nor can they have any vote in the affairs of the Society.

4.8. If a member resigns from the Society, he/she/it cannot claim any of the goods or assets of the Society, nor claim repayment of any dues previously paid.

Article 5. MEMBERSHIP RIGHTS AND OBLIGATIONS

5. Members have the right to participate at the General Assembly. They will receive the newsletter of the Society and have the right to question the members of the Board. The members have an obligation to pay the membership dues and comply with the Statutes and Rules of the Society. The dues to be paid cannot be higher than the amount agreed by Council at its last meeting. The Secretariat will communicate the amount of the membership dues to be paid at the request of a member or applicant for membership.

TITLE III. The Structure of the Society

Article 6. ORGANISATIONAL STRUCTURE

The Society has the following organisational structure:

6.1. General Assembly, comprising all members
6.2. Council
6.3. Board
6.4. Executive Committee
6.5. Sections, Commissions and Working Groups
6.6. Secretariat

Article 7. GENERAL ASSEMBLY

7.1. The General Assembly has all the powers not assigned to the Council and the Board in accordance with the Society's Statutes and the law.

7.2. The General Assembly confirms the election of the President and Members of the Board. (see art. 8.4.).

7.3. At every meeting of the General Assembly, the Board is required to render a report, including a financial statement, and to present its forward plans covering the period until the next meeting of the General Assembly.

The General Assembly ratifies the annual reports provisionally approved by the Council conform Article 8.5.1.

7.4. The quorum for the meeting of the General Assembly is not less than 75 members of the Society. Voting is by simple majority except in the case of dissolution of the Society.

7.5. The General Assembly meets once every four years on the occasion of the Congress mentioned under article 13.

The General Assembly is invited at least by means of an announcement published in the Society's official publication "Chronica Horticulturae". This invitation is signed on behalf of the Board by the Secretary of the Board, or by the President of the Society.

The date and place of the General Assembly are stated in the announcement. An agenda will be issued to the membership no less than four months before the date of the meeting.

7.6. The General Assembly considers and confers Honorary Membership as recommended by the Council.

7.7. The resolutions of the General Assembly are published in summary in the official publication of the Society, "Chronica Horticulturae".

Article 8. COUNCIL

8.1. The Council consists of representatives of the country/region (the word 'state' is dropped) members, representatives of the individual members citizens of non-member countries (the word 'states' is dropped), and representatives of Individual members of geographical regions recognized by the Council.

Each country/region (the word 'state' is dropped) member can appoint up to a maximum of three Council members but each country/region member has only one single vote in the Council.

Individual members, who are residents of non-member countries or other geographical regions recognized by the Council, elect per country/region and from their ranks, by simple majority, a representative. This representative has one vote on the Council.

The Council consists at least of twenty-five voting members.

Council members are in office for a term of two years, which is renewable.

8.2. Council Members of the Society are appointed according to the procedures of the country/region (the word 'state' is dropped) concerned.

8.3. The Council has the powers assigned to it by the General Assembly.

8.4. The President of the Society is elected by the Council and chairs its meetings. In the President's absence, the Vice-President of the Board takes the chair. If both the President and the Vice-President of the Board are absent, the Council elects a chairperson for that meeting.

8.5. The Council normally meets once every two years, having been invited formally to:

8.5.1. approve provisionally the annual accounts, and will submit these for ratification to the next General Assembly

8.5.2. receive the reports of the Board and Executive Committee

8.5.3. receive and approve the forward plans including the financial budget

8.5.4. fill any vacancies within the Board for the period until the next General Assembly

8.5.5. transact any other business.

8.6. Upon a request from 10 voting Country/region members, the Board can invite the Council to call a special meeting.

The Council is invited by regular mail addressed to each of its members at least two months prior to the meeting. This invitation is signed on behalf of the Board by the Secretary of the Board.

An agenda will be included with the invitation.

8.6.1. The quorum for a Council meeting is reached:

- if one third of the Country/region (the word 'State' is dropped) representatives, entitled to vote, are present or represented
- and if at least one representative of each of the geographical regions (i) Europe, (ii) North and South America, (iii) Oceania-Asia-Africa is present or represented.

8.7. Decision making may be by a show of hands. When voting is required votes are cast orally unless a voting representative or the Board demands a ballot. Votes relating to persons are taken by ballot. The Chairperson only votes in the case of a tie.

8.8. At each meeting, minutes are taken, adopted by the Council at its next meeting, and then signed by the President, the Secretary of the Board and two other Council members, as a true and accurate record.

Article 9. BOARD

9.1. The Board consists of not less than five, nor more than nine, members who are elected by the Council and confirmed by the General Assembly. In addition, the Executive Director and the Congress President are *ex officio*, non-voting members.

9.1.1. The Council is empowered by the General Assembly to appoint,

discharge or suspend from duties any Board member in the period between General Assemblies.

9.2. The Board has the power assigned to it by the General Assembly and Council.

The Board is empowered with the management of the Society to enter into agreements with a view to the acquisition, encumbrance, and disposal of the assets of the Society.

9.2.1. The Board is represented legally by the President. If the President can not act, two other members of the Board act together.

9.2.2. The Board delegates day-to-day management of the Society as well as representation for this management to one or more of its members, directors or other agents, acting alone or together.

9.2.3. In case of delegation, the Board lays down the terms of the assignment and if appropriate, any special financial arrangements required by the assignment.

9.3. The Board is responsible for the financial governance of the Society. Financial decisions must be agreed by a three quarters majority of elected Board members.

9.4. The Board prepares the agendas for the meetings of the General Assembly, the Council and the Executive Committee.

9.5. The Board will empower and control the Executive Director.

9.6. Board members retire at the end of each General Assembly, provided that a new Board has been appointed. They may be reappointed for one consecutive term if eligible.

9.7. In the event of a vacancy on the Board between General Assemblies, the Council is empowered to fill the vacancy.

9.8. An employee of the Society is not eligible to be a voting member of the Board. ('while still in office' was removed).

9.9. The President of the Society is Chairperson of the Board. The Board elects a Vice-President, a Secretary and a Treasurer from within its own ranks. In the event of absence of the President, the Vice-President acts temporarily for the President. If both President and Vice-President are absent, the Board elects another person from within its own ranks to act temporarily for the President for the meeting.

9.9.1. A Board member cannot hold more than one permanent position on the Board.

9.10. A quorum is a majority of the elected Board members.

Any member of the Board absent from a Board or Council meeting, can provide a proxy in writing, by telefax, telegram, telex or e-mail to one of his/her colleagues to represent him/her at the meetings of the Council or the Board and to vote on his/her behalf. The Board member will, in this case, be reported present. The number of proxy votes held by any one member of the Board is not limited.

9.11. At each meeting, minutes are taken, adopted by the Board at its next meeting, and signed by the President, two members of the Board and the Secretary as a true and accurate record.

9.12. The managerial functions of the Board are specified in the Rules of Procedure for the Society.

Article 10. EXECUTIVE COMMITTEE

10.1. The Executive Committee consists of the Chairpersons of the Sections and Commissions plus the members of the Board, and is chaired by the Vice-President.

10.2. The Executive Committee is responsible for the scientific and technical work of the Society. It reports through the Board to the Council.

Article 11. SECTIONS AND COMMISSIONS

11.1. Sections and Commissions of the Society consist of members who undertake the scientific and technical work of the Society and may form Working Groups.

11.2. The Chairpersons must be confirmed in office by Council after an election by the members of Sections and Commissions.

They report to the Executive Committee, which again, through the Board, reports to the Council.

11.2.1. The Council is empowered by the General Assembly to appoint, discharge or suspend from duties any Section or Commission Chairperson in the period between General Assemblies.

Article 12. SECRETARIAT

12.1. The Secretariat is headed by the Executive Director, who is appointed by the Board with the approval of the Council.

12.2. The Executive Director is responsible for the management of the Society in accordance with the policies and directives agreed to by the Board, acting on behalf of the Council.

Article 13. CONGRESS

13.1. The Congress is normally held every four years. The date and place are recommended by the Council and approved by the General Assembly.

13.2. The Congress promotes the advancement of horticultural science, on behalf of the Society, by means of invited and contributed scientific papers, workshops, Section and Commission meetings, and plenary sessions.

13.3.1. During the Congress there is a General Assembly, which is open to all members of the Society.

13.3.1.1. The Congress President is nominated by the Organizing Committee of the Congress and appointed by the Council.

TITLE IV. Finances

Article 14. FINANCES

14.1. The financial year of the Society is the calendar year.

14.2. Sources of income for the Society comprise:

14.2.1. annual dues and subscriptions

14.2.2. sponsorships

14.2.3. donations and bequests

14.2.4. revenues from the sales of publications

14.2.5. all other legal revenues.

14.3. With the exception of Honorary members, the members are required to pay annual dues, the level of which will be fixed by the Council.

14.4. The Council is empowered to grant exemption, either in whole or in part, from the obligation to pay annual dues or subscriptions.

14.5. Records of the financial position of the Society are kept by the Board and reported to the Council.

14.6. The financial records of the Society are subject to an annual independent audit. An external auditor is appointed by the Board on the recommendation of the Council. The summary of the audit report is made available annually to the membership.

14.7. An internal Audit Committee, of at least two persons, is appointed by the Council, from within its own ranks. The Audit Committee reports to the Council. Members of the Audit Committee must not be Board members.

TITLE V. Amendments to the Statutes, Dissolution, Rules of Procedure and Disputes

Article 15. AMENDMENT TO THE STATUTES

15.1. An amendment to the Statutes can only be made by means of a members resolution, considered first by the Council and then submitted, with comment, to the General Assembly.

15.2. At that Council meeting there must be 50% of the voting member countries present, or by proxy, in accordance with the geographical divisions specified in the Rules of Procedure. There must be a two-thirds majority of the votes of this Council in making the recommendations.

In addition, the amendments will only be adopted with the support of:

- either twenty individual members
- or six institutional members distributed over the three geographical regions (i) Europe, (ii) North and South America, (iii) Oceania-Africa-Asia.

Article 16. DISSOLUTION

16.1. The Society can only be dissolved by Council following the adoption of a resolution accepted by a two-thirds majority vote of members at a General Assembly.

16.2. The net proceeds, after settlements, will be given to one or several organization(s), as designated by the Council, that promote the interests of horticultural science and education.

16.3. In the event of dissolution, the General Assembly appoints the liquidators and determines their powers. The liquidators will have the same powers as the members of the Board. If no liquidators are appointed, the members of the Board act as liquidators.

Article 17. RULES OF PROCEDURE

17.1. The Board, authorized by the Council, is empowered to draw up Rules of Procedure, and make any subsequent amendments for consideration by the Executive Committee and for approval by the Council.

17.2. These Rules must not be contrary to Belgian law nor to the Statutes of the Society.

Article 18. DISPUTES

18.1. Everything which is not covered by these statutes will be ruled by the content of Title III of the Belgian law of 27 June 1921 on the not for profit associations, on not for profit foundations and international associations.

The Journal of Horticultural Science & Biotechnology (JHSB) – Fully Digitised

From 1st January 2010 all the volumes of JHSB (starting with Volume 1 Issue 1 from 1919) are available online in electronic format. Previously, only those volumes published from January 1999 were available electronically to JHSB subscribers, members of ISHS and Pay-for-View customers. As a result of a substantial financial investment by the Trustees of JHSB all volumes have been professionally digitised. Researchers, JHSB subscribers, ISHS members and any other customers wishing to make access to this new service may do so either via the Journal's webpage (www.jhortscrib.com) or the ISHS website (www.pubhort.org/jhsb/). Subscribers to the Journal can make access to back issues by using their unique Username and Password. Automatic IP address authentication has been incorporated into this new service; consequently, subscribers who have registered their IP address ranges with JHSB do not require a Username / Password to make access to articles. Members of ISHS who wish to consult past articles in JHSB may also do this using their own Username and Password.

All past research papers that have been published in JHSB are included in this facility. Additionally, non-research material, such as assessments of research methodology, meeting reports and book reviews which have from time-to-time been included in JHSB, are also digitised and available electronically. In order to retain conformity with current publishing practices however, this material is only available by application to the Journal's officials with whom special purchasing rates may be negotiated. Digitisation of JHSB has been accomplished by the same British Company that was employed by ISHS to digitise back issues of *Acta Horticulturae*, this has generated an appearance and access tools that are as uniform as possible.

Comments from users are most welcome. All digitised texts have been checked in so far as is feasible. If users find errors and / or omissions please advise the Journal so that steps may be taken to rectify any problems.

Professor Geoffrey R. Dixon, Chairman of Trustees to the *Journal of Horticultural Science & Biotechnology*

ISHS Governance Meetings at the Lisbon Congress: Important Announcements and Information

Dear member of the International Society for Horticultural Science,

2010 is a Congress year and according to Society bylaws there must be a General Assembly where members receive formal reports from the Board, consider amendments to the ISHS Statutes, recognize worthy colleagues and confirm important future events. The following information includes pre-Congress announcements and invitations required by our Statutes.

A. ISHS GENERAL ASSEMBLY - INVITATION TO THE MEMBERSHIP

ISHS is experiencing exciting times and the outgoing Board is looking forward to reporting on the growth and development of the Society during the last four years. This meeting also provides an opportunity for members to accept or reject important Council decisions or recommendations and to voice their comments, concerns and suggestions for Board consideration.

The 2010 ISHS General Assembly will take place at the Congress Convention Centre in Lisbon, Portugal on Tuesday, 24 August 2010, 12.30 h – 14.30 hours. This is mid-day on the second full day of the Congress.

The Agenda for this meeting is as follows:

1. Opening by the President
2. Board Member Reports for the 2006-2009 time period
3. Proposed amendment to the ISHS Statutes
4. XXIX International Horticultural Congress - Australia
   - 4.1. Inauguration of the President of the XXIX IHC
   - 4.2. Information about the XXIX IHC
5. Announcement of the Date and Place of the XXX IHC
6. ISHS Fellow, Honorary Member and other Awards
7. Confirmation and Inauguration of the new ISHS President and Members of the Board
8. Other Business
9. Adjournment

B. ISHS MANAGEMENT MEETINGS (*) AT THE TIME OF THE CONGRESS

a) Meetings of the Board of Directors

Monday 16 August and Tuesday 17 August

b) Meeting of the Executive Committee

Wednesday 18 August and Thursday 19 August 2010, 8.30-18.00 h, Corinthia Hotel, Lisbon

c) Joint Meeting of the Council and Executive Committee

Friday 20 August and Saturday 21 August 2010, 8.30-18.00 h, Corinthia Hotel, Lisbon

Thursday 26 August 2010, 10.30-13.00 h, Congress Convention Centre, Lisbon

(*) Time schedules and Agenda available from the ISHS Secretariat

C. BIDS WELCOMED FOR FUTURE ISHS CONGRESS HOSTS

At the above-mentioned meeting at Lisbon this coming August, the ISHS Council will evaluate proposals for the Congress to be held in 2018. Representatives of ISHS Country/Region Members interested in bidding for that Congress are invited to provide the ISHS Secretariat with a letter of intent. The Secretariat will, upon receipt of this letter, provide more detailed information and instructions. The deadline for receiving the letter of intent is June 1, 2010.

D. CALL FOR NOMINATIONS: ISHS FELLOWS AND HONORARY MEMBERS

The ISHS Board invites the members of the Society, to bring possible candidates for an ISHS Honorary Membership and ISHS Fellowship to the attention of the Society. Nominations should be accompanied by five (5) letters of support, giving reasons why a nominee is considered worthy of an honour; these letters must come from members in no less than three (3) different countries. Nominations must be received by the Executive Director of ISHS at least three months prior to a Council meeting.

The Executive Director will collect the suggestions and will send these, together with the letters of support, to the Nominations and Awards Committee.

The Nominations and Awards Committee (which consists of around 6 persons on a 4-year rotation system) will discuss and select the suggestions that were received and send them with a motivated recommendation to the ISHS Board at least six weeks before a Council meeting.

The Board will discuss the recommendations made by the Nominations and Awards Committee and send the final, motivated nominations to the Council, which will decide who will receive the Awards - following the procedure set in article 3d and 3e of the Rules of Procedure of the ISHS.

The presentation ceremony takes place at the International Horticultural Congress during the General Assembly of the ISHS.

The names of Fellows and Honorary Members will forever be included in the membership directory.

ISHS Fellows

The ISHS Fellow Award will be presented to a person who is a member of ISHS, in recognition of this person's outstanding contribution to horticultural science worldwide. A precious metal pin and a certificate will be given to the recipients of this award. The total number of ISHS Fellows shall not exceed 1% of the total membership, averaged over a period of 4 previous years.

ISHS Honorary Members

Honorary Membership of the ISHS will be given by the Council to a person who is a member of the ISHS, in recognition of his/her exceptional service to the Society. A certificate will be given to the recipients of this ISHS Award.

Upgrading European Fruit Produce and Quality

Silviero Sansavini

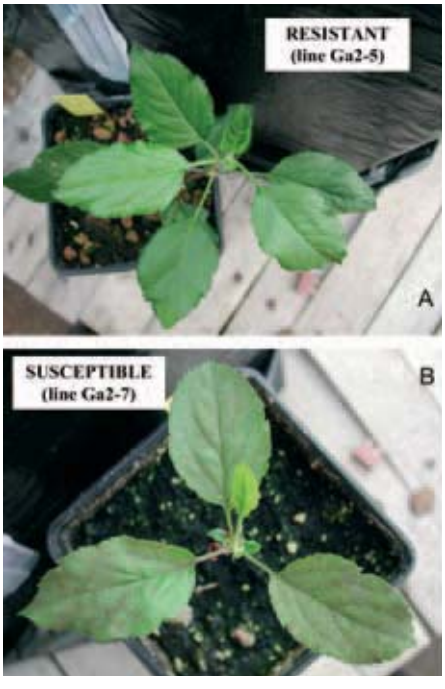
Technical innovations and new breeding and biotech strategies are successful tools for fruit improvement. New generations of genetically modified (GM) fruit plants, all banned, wait to be exploited in Europe.

We keep hearing certain questions from growers about the horticultural industry's future. The most often heard include "what are the best technical innovations in the pipeline to upgrade our produce?"; "what impact have industry-specific biotech tools had so far?"; and "what can we expect of them in the future?" What growers are really asking is whether they are being left to their own devices in the field and to the usual forces in the marketplace or whether they can still look forward to innovations and novelties at the production end of what is becoming a long fruit and vegetable supply chain. Yet, before trying to answer these questions, let us take a look at where we are today and then look at where we may go in future.

THE PRESENT SITUATION

Generally speaking, few would deny that the produce we find on sale in our markets today is far safer than ever before. This is in no small measure due to management protocols for both integrated and organic crops in force throughout the supply chain in the European Union (EU) today, including the export side, and such recently revised or newly introduced quality standards that now appear on category labels, including origin, traceability, residue thresholds, and the like. All of this has been made possible by the efforts of those researchers who have harnessed and developed for practical application the technological innovations that have enhanced our ability to better safeguard rural environments, to employ non-renewable resources more efficiently and to make produce commodities healthier for consumers. Perhaps the key tool in advancing this agenda is the breeding and introduction of new plant material that is less susceptible to adversities, better adapted to management systems of lower environmental impact and more in line with the stricter quality standards demanded by today's markets. The overall upshot has been produce commodities that are more competitive in the marketplace because they are grown under more efficient regimes of energy inputs like fertigation that notably reduce soil, water and atmospheric pollution and chemical residues while boosting soil fertility.

Yet it must be said that much more could have been done had public-sector research efforts in major producer countries like Italy enjoyed more resources while being better organized and coordinated on both national and EU scales, including more viable R&D partnerships at the international level. It must also be said, though, that the R&D networks supported by the various EU Commissions have triggered notable collaborative mechanisms and high-tech innovations under numerous public-private partnerships. Indeed, these policy efforts have made the participation of private industry stakeholders in jointly financed projects the norm in Europe today. While this *modus operandi* has enabled leading producers like Spain and Italy to contribute to and to take advantage of EU research efforts and their results, thereby leading to a radical revision of the mental "business model" of their horticultural research teams, this working framework is still far from the optimum it can be.



Scab symptoms on GM-apple leaves: (A) the GM-line carrying the scab resistance gene *HcrVf2* (Ga2-5) is scab-resistant and (B) the control line (Ga2-7) without the gene is scab-susceptible (DCA, University of Bologna).

It is in this connection hardly surprising that the major high-tech inputs from basic and applied research are being realised by those countries that have allocated the most resources to such key R&D areas as genetics, physiology, agronomy, and information technology. The downside is that small- or medium-sized countries may find their institutional resources stretched so thinly over the national, regional and local levels that it becomes very difficult in effect to generate the results needed to deliver significant returns on investment.

The world's fruit industry has benefited enormously in the last 10-15 years from several thousand new cultivar releases, the yearly average being about 80 for peach, 50 for apple, and 10-40 for pear, plum, cherry, and apricot. Never in the history of the industry has there been such a formidable deployment of novel genetic material, a fact due largely to the efforts of private-sector breeders backed both by traditional patent laws and, more recently, by licensing the exclusive property and propagation rights to their novel varieties throughout the produce supply chain.

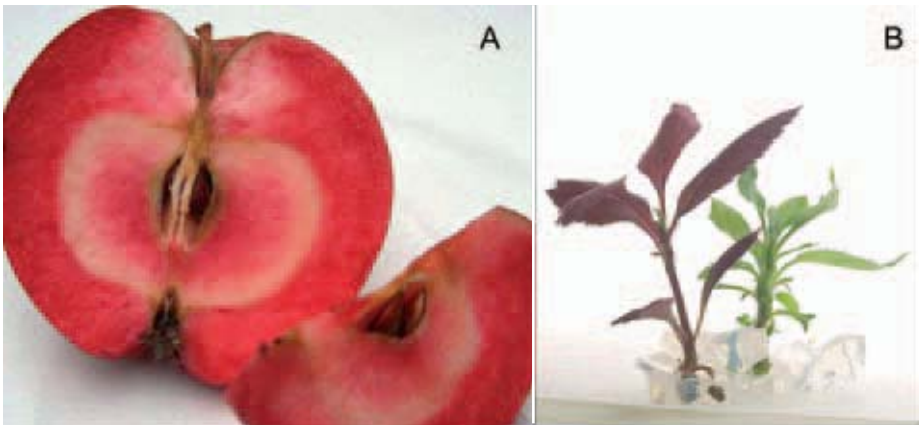
Innovation was also the end-product when integrated and organic farming protocols were adopted. In effect, these field management guidelines resulted in drastic restrictions regarding the use of crop protection chemicals, which in turn led to profound changes in such planting criteria for intensive orchards and vineyards as density, the use of novel rootstocks to reduce tree height to facilitate management operations, soil management practices for reduced environmental impact and enhancement of fruit quality. These innovations not only improved field practices but also resulted in overhead savings that were most notable in terms of working hours because of the greater precision of computer-based tools linking extension services and growers for input scheduling, real-time monitoring and forecasting. Suffice it to note in this connection the enormous savings of water and nutrient inputs with deficit-control irrigation, a method that also reduces waste, pollution, and adverse effects on crops.

BIOTECHNOLOGICAL LINKAGE

This is the point at which we link up with biotechnology. It is opportune at this juncture to make a strategic distinction. As we shall do in what follows, it is best to keep our comments about biotech innovations like molecular tools applied to genetics and genomics clearly separate from those about biotechnology in its more limited sense like genetic engineering to produce genetically modified organisms (GMOs). The reason for this distinction is that the goals that each attempt to pursue are different and understanding the differences and limits of each is important. Both categories are fairly inter-dependent at times, or can derive from applying research findings, gene identification and isolation, and end up in genetic transformation.

Europe has shown that it can compete on the world stage in biotech tools. It has the abilities and skills to acquire technology know-how like identifying and mapping molecular markers for assisted selection, gene isolation, pursuit of differentially expressed sequences, such as those for health and nutraceutic compounds such as flavonoids, coding for amino acids, proteins, allergens, that can be used for industrial applications, spin-offs and even setting up small enterprises. There are a number of research teams today working in areas of fruit physiology, protection, yield efficiency, ripening, quality and metabolic processes like disease-resistance mechanisms, leaf and whole-tree gas exchange, root uptake, fruit softening and shelf-life.

The sequencing of the grapevine and apple genomes by Italian researchers at IASMA in San Michele all'Adige, the universities of Udine, Milan, Padua, Verona, and other stations, as well as those of maize, potato, and tomato by other European teams, is the result of large inter-disciplinary research projects managed on an international scale with budgets that, as in the case of grapevine, can go as high as € 10 million per project. These efforts have led to significant findings and advances. The same amount was budgeted in France for a grapevine effort in a joint public-private funding effort. Thus, there is a domino effect at work here that will be a driving force in future joint projects, whether those that stem directly from researchers or suggested by producers and their organizations. The benefits and practical impact of these research efforts should advance our understanding and use of genetics in traditional breeding practices and help the global fruit industry develop new cultivars and improve management techniques, bringing it more into line with market trends and emerging consumer demands. It is also important to assure an equitable return on investment for growers since many orchard holdings are falling on hard times because of marketing problems and high overhead. One example of this is grapevine. It is a sector for which the outlook over the near term



(A) Cut fruit with bright red flesh, caused by extremely elevated level of anthocyanins. These compounds have health promoting effects due to anti-oxidant activity. This fruit is of a naturally occurring ornamental variety and has bad taste. (B) Cisgenic genotypes with red flesh are expected to taste good (courtesy Henk Schouten, Wageningen).

holds the promise of new cultivars being bred in Europe that will be resistant to a number of pathogens, thereby helping to bring on line top-quality wines having a competitive edge over the best ones on the market today. However, there is some resistance in the industry due to the "appellation" problem in wine.

GMOs have been denied the chance to develop in Europe, except for the 100,000 ha of maize sprinkled in 8 of the 27 EU member states. This despite the keen initial interest the sector aroused in the 1990s. Many EU governments, including Italy, have for over a decade now banned research and testing, thereby stifling creativity and even the chance to undertake field trials of GM plants. In effect, there is no genetically modified horticultural crop being grown in the European Union today, nor are any imported for marketing purposes. The ban is on the other hand a moot point in that there are no GM orchard crops at all for the moment. Nor is there imminence in Europe, despite the fact that GM grapevine, potato, and tomato await testing in several EU states and any decision about their marketing is still a long way off. Genetically engineered fruit species have not got off the ground at all in Europe, despite considerable research.

This because the European Union views GMOs with a negative bias that is in line with public opinion. Governments of member states are even inclined to ban any co-existence with conventional crops, the GMO-free declaration by 13 member countries being a good example. As Europe continues to enforce the GMO ban except in the rarest of cases, several such crops exist at the experimental level that are totally resistant to damaging diseases that today continue to require numerous chemical treatments to escape the damage. Italy is a good example of this problem. It fears that allowing GMOs will compromise quality trademarks of premium foods and produce that carry locally raised or grown labels. This policy stance, however, no longer holds when it comes to the big commodities such as maize and soybean because the country needs imports for its livestock feed industry even if they are genetically modified. Italy thus admits imports of maize, soybean meal, and canola oil from countries in North and South America that do not require label listings. The upshot is that most (up to 70% in certain cases) of its animal feed is likely to come from GMO crops.

While no one talks any longer about "Frankenstein foods" since initial fears of the danger posed by GMOs have largely been consigned to the dustbin of history, concerns still persist about the potential GMO crops pose in terms of contaminating other plant species and soil. The main issue at stake here is whether transgenes can migrate from GM crops to wild plants that are relatives or genetically similar or even to other crops that are not. There is also concern about "gene flow" towards microbe populations in the soil and the attendant risk to the environment, a threat that is possible in theory but probably of negligible impact. A monitoring survey conducted over the last three years by Italy's Ministry of Agriculture has reported that while temporary soil contamination does in effect occur, it generates no dangerous effects, at least in the short term.

The upshot is that the invocation of the "precautionary principle" by EU member governments opposed to GMOs, a call backed by a large segment of the farm industry through its producer organisations, continues to hold the policy reins. As a result, the ban on the cultivation of GM crops and the importing of feed containing them remains in place. In actual fact, an even more important lobby group in this connection is the movement headed by the authorities of the so-called "GMO-free" regions, which even back the ban on co-existence. The leaders in the movement are found in Austria, Germany, France and Italy, as well as other countries. However, it will be difficult in the near future to keep the ban on the third- and fourth-generation GM crops that will no

longer be the private preserve of multinational corporations. These future crops will be more friendly to the environment, capable of contributing to biodiversity, more resistant to pests and diseases, hardier and more energy efficient while containing improved quality traits and offering consumer higher or total food safety and other dietary benefits.

The future augurs a number of surprises, many unforeseen. One expectation is the contribution GMO crops will make to alleviate starvation in Africa and Asia when grain reserves will no longer be sufficient to feed populations at risk, or when, as we have recently seen, they become too expensive. The solution in many such cases will come from crops that are resistant to drought and salinity. Fruit and vegetables bred via GM techniques should help to improve dietary wellness and foster healthier life-styles enabling the protection of nature and the environment.

What is going to happen? The example of China comes to mind. China, one of the largest countries to have freed itself of the accusation of being under the thumb of the big multinationals, is actively developing new GM plants for its market in national universities and research stations. Examples of this program include Bt cotton, which is widely grown there today, and genetically engineered rice, ready to be widely cultivated by Chinese farmers once the final environmental impact reports are in.

CISGENIC PLANTS

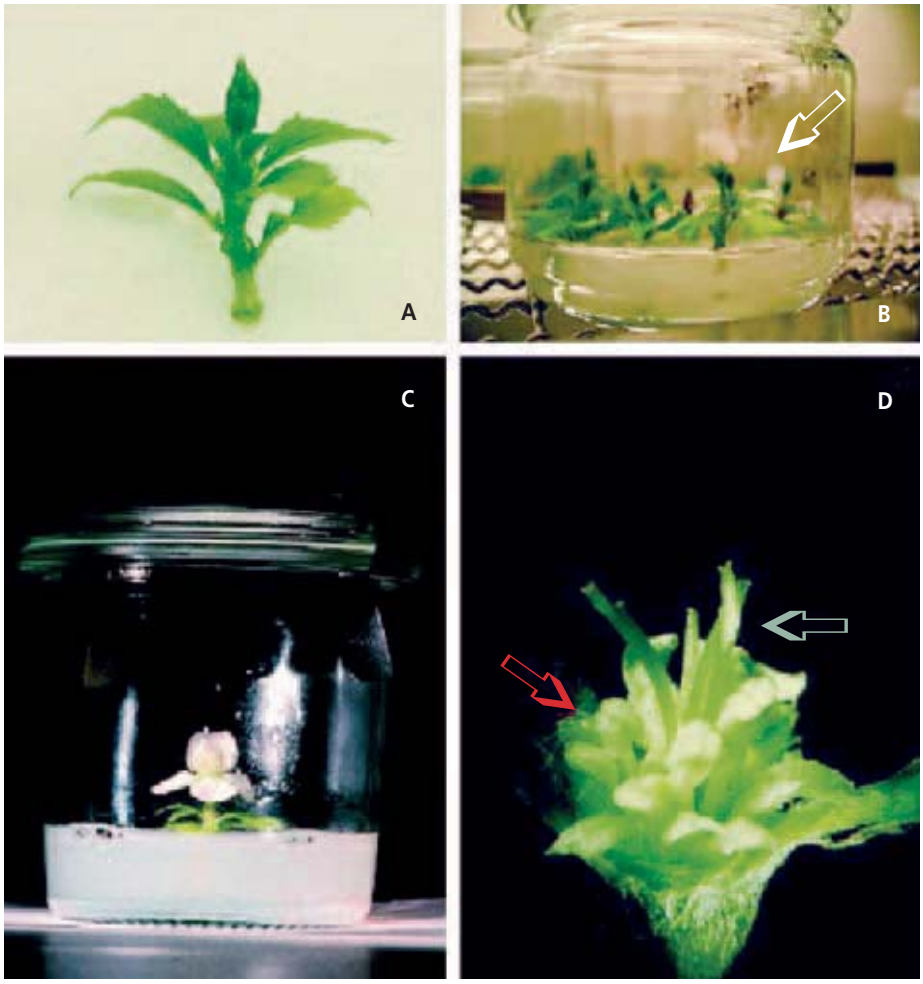
A few words are in order at this juncture about cisgenic plants, the latest twist in GMOs. Now under testing in Holland, Switzerland and Germany, these plants do not contain heterologous transgenes, i.e. they are not bred with genes from foreign species that have been artificially introgressed into gene constructs. Will public opinion be opposed to cisgenic plants as it is to other GM crops merely for ethical and ideological reasons? These plants are altogether similar in their genomes to conventional crops and, hence, should not involve any more risks than from traditional breeding practices. It is to be hoped that science will be quick to demonstrate and to verify this. We are talking about crop plants that have been engineered by merely inserting a single gene sequence from another plant *of the same species or genus* completely free of foreign genetic markers. This process is achieving the same goals as traditional breeding by sexual reproduction but at a much more rapid pace avoiding the consequences of recombination or the many years required for backcrossing. The acceptance of cisgenesis by public opinion and policy-makers should pave the way for transgenic breeding.

One example of cisgenic breeding was the joint effort of Bologna and Zurich universities in developing a scab-resistant 'Gala' apple by inserting *Vf* gene from another apple genotype. Recently, in a joint project between Zurich, Bologna and Hannover universities, a scab-resistant version of 'Elstar' was achieved using constituent native promoters of differing length of the same *Vf* resistance gene. Field trials have been on hold for several years now and we are still waiting for the go-ahead to begin them.

THE FUTURE FOR EUROPEAN BIOTECHNOLOGY

I foresee the day when Europe's growers, consumers, and policy-makers will finally accept GMOs. But, will it be a victory of too little and too late. I fear we may have missed the opportunity that awaits us now to employ the best efforts, minds, and skills of our present generation of young scientists. In all probability we will have to bear extra costs needed to catch up and reap the benefits of the biotechnology to improve our crops. The delay that has accumulated is a gap that may no longer be bridged and could compromise market share and erode any edge European industry has in the highly competitive global produce industry.

Generation of flowers on in vitro shoots in apple transformed by a MADS box from silver birch (*Betula pendula*) to induce early-flowering (Flachowsky et al., 2007).



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Flachowsky, H., Peil, A., Sopanen, T., Elo, A. and Hanke, V. 2007. Overexpression of *BpMADS4* from silver birch (*Betula pendula* Roth.) induces early-flowering in apple (*Malus* x *domestica* Borkh.). Plant Breeding 126:137-145.

ABOUT THE AUTHOR

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Chlorophyll Fluorescence: Applications in Postharvest Horticulture

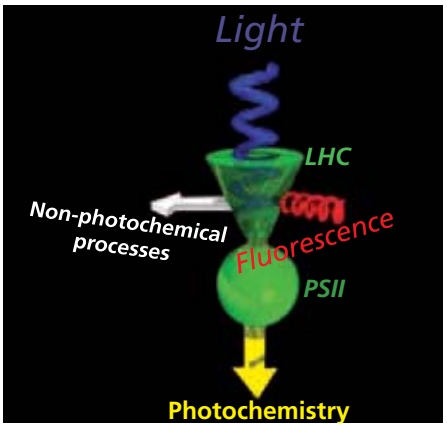
Robert K. Prange, John M. DeLong and A. Harrison Wright

Chlorophyll fluorescence is an interesting scientific phenomenon that is useful to scientists working with plant chloroplast physiology. The development of the HarvestWatch™ system for measuring chlorophyll fluorescence has enabled this technology to have practical applications. Since 2004, its ability to detect low oxygen stress has re-invigorated the refinement of Controlled Atmosphere (CA) technology, allowing the introduction of Dynamic Controlled Atmosphere (DCA) storage. The use of DCA has enabled the apple industry to eliminate the use of several postharvest chemicals prior to storage and meet the demands of consumers. Research has shown HarvestWatch™ is also capable of detecting other important postharvest stresses affecting quality, e.g. temperature and water loss.

PRINCIPLE OF CHLOROPHYLL FLUORESCENCE

The principle of chlorophyll fluorescence has been known to plant scientists since it was first described by Kautsky and Hirsch (1931). Light entering a plant chloroplast is absorbed by the chlorophyll and related pigments (Fig. 1), and most of the energy is used in photochemistry, which results in carbon fixation (sugar production). However, some of the energy cannot be utilised and is converted into non-photochemical energy (heat) or is emitted (fluoresced) at a longer wavelength with maxima at ca. 690 and 730 nm. This fluorescence emission from intact green plant tissue is not visible but it is easily observed in chlorophyll-containing solutions that are illuminated with 400-700 nm wavelength irradiance (Fig. 2).

Figure 1. Diagram showing visible light (blue) entering the chloroplast (green) and being absorbed by the Light Harvesting Complex (LHC) and Photosystem II (PSII) systems in the chloroplast. Most of it is used in photochemistry to make sugar (yellow). However, a small amount is released in non-photochemical processes as heat (white) or emitted (fluoresced) from the plant at a longer wavelength (red).



The fluorescence signature begins immediately after exposure to light and follows a predictable pattern known as the "Kautsky" curve. If the chlorophyll has not been exposed to light for at least 30 minutes (dark-adapted), the first fluorescence emission after exposure to a weak red (<1 μmol m^{-2} s^{-1}) light source is called the minimum fluorescence (F_o). If the light is increased to a saturating level, the fluorescence increases to a maximum, which is called F_m (Fig. 3). The red glow in Fig. 2 is chlorophyll fluorescence in response to the saturating light exposure.

CHLOROPHYLL FLUORESCENCE USEFULNESS TO HORTICULTURISTS

Chlorophyll fluorescence is an attractive tool for horticulturists and plant scientists because it is very sensitive to changes in the metabolic status of the plant. Chlorophyll fluorescence is well-known to be responsive to preharvest and postharvest stresses, both abiotic (e.g. temperature, water, mineral, atmospheric gases), and biotic (e.g. plant pests) (DeEll et al., 1999). Chlorophyll fluorescence, compared with other techniques for monitoring metabolism, is particularly appealing to horticulturists and plant scientists due to the following features:

Figure 2. A visual example of chlorophyll fluorescence. A white light from a fibre-optic source is shining on a chlorophyll solution. The red glow is chlorophyll fluorescence.

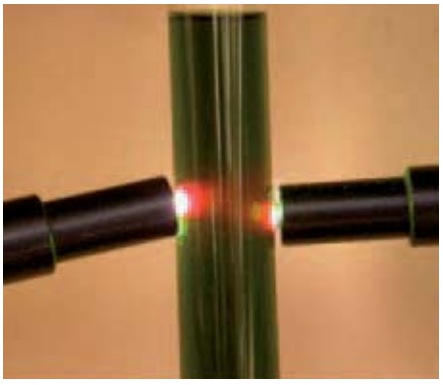
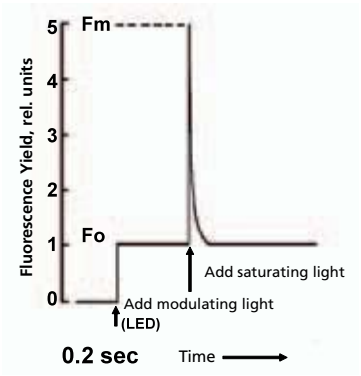


Figure 3. Typical fluorescence change over time when it is illuminated in the dark. Under stress either (or both) the F_o and F_m can change.



- Non-destructive
- Surface area measurements of any chlorophyll-containing fruit or vegetable
- Rapid
- Frequent repeat measurements of samples possible
- Non-chemical
- Virtual, real-time monitoring of produce samples
- No calibration needed while in operation

The traditional chlorophyll fluorescence instrumentation was designed for manually-controlled repetitive measurements on a small surface area in a laboratory environment, as depicted in Fig. 4. Such instruments have provided some useful information but are costly and unable to provide automated repeat measurements on large samples of material. In order to circumvent these problems, we devised a new chlorophyll fluorescence technology in collaboration with Satlantic Inc. of Halifax, Nova Scotia (a Canadian scientific instrument company specializing in optically-based sensors). The advancement in technology allowed for inexpensive automated repeat measurements on a large surface area of fruits or vegetables. This new HarvestWatch™ system (Fig. 5) is patented (Prange et al., 2007) and licensed to Isolcell Italia S.p.A., Laives (BZ), Italy. The technology is

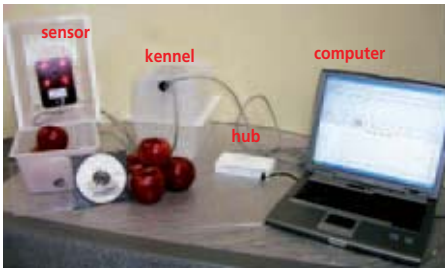
Figure 4. Example of a typical manually-operated chlorophyll fluorescence system. Chlorophyll fluorescence measurement using this type of system is expensive, manual, time-consuming and incapable of sampling large areas of a fruit or vegetable.

designed specifically to generate an approximation of F_o, the initial fluorescence detected if kept in the dark-adapted state. Instead of calling it F_o, we have labelled it as "F_α", a value generated through Pulse Frequency Modulation (PFM) and an algorithm that it is partly influenced by both F_o and F_m. The HarvestWatch™ system is designed to operate primarily in dark postharvest environments where there is no extraneous light and where the fruit or vegetable product can be monitored for extended periods without disturbance.

SUCCESSFUL APPLICATION

The HarvestWatch™ system has proven to be very effective in both commercial store rooms and in research laboratories. There are no mechanical or chemical components that need replacement. It has a very low signal-to-noise ratio and is capable of detecting a fluorescence signal from tissue containing very little chlorophyll, e.g., potato tubers, mature 'Golden Delicious' apple fruit.

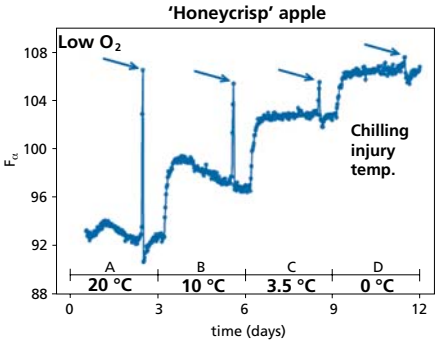
Figure 5. The Chlorophyll Fluorescence HarvestWatch™ system makes continuous non-destructive measurements of chlorophyll fluorescence, measured as F_α, and displays it in real time. The system consists of the fluorescence sensor unit affixed in an upper sampling kennel (left), apples (or other product) in the bottom kennel and a central hub (middle). Before storage, apples are placed in the bottom kennel over which the upper kennel housing the fluorescence interactive response monitor (FIRM) unit is securely fastened. In storage, the FIRM units are wired to the hub, which controls the interaction of electronic signals from a central computer (right) to each attached FIRM device.



Temperature is the most important factor in postharvest handling and storing of fruits and vegetables; the HarvestWatch™ system provides useful scientific and practical information about the effect of temperature on chlorophyll fluorescence emission (Wright et al., 2010). In Fig. 6, there are 4 progressively colder temperatures (20, 10, 3.5 and 0 °C); at each, there is an increase in the baseline value of the F_α signal. Also, the downward direction of F_α changes noticeably when the temperature is altered, particularly at 3.5 and 0 °C (interestingly, 0 °C can cause chilling injury in 'Honeycrisp' apples). Although the physiological mechanism causing these shifts is unknown, these data demonstrate that chlorophyll fluorescence is sensitive to, and can potentially monitor temperature changes.

The HarvestWatch™ system's first successful application was the detection of the lowest acceptable oxygen that can be used in Controlled Atmosphere (CA) rooms (Prange et al., 2003; DeLong et al., 2004). Some fruits and vegetables, especially apples, can be stored longer if held in CA conditions in which the oxygen is held as low as possible without damaging the fruit. In some apple cultivars, e.g. 'Granny Smith', 'Delicious' and 'Cortland', this procedure is also used to stop the appearance of superficial scald, which destroys the market value of the fruit (DeLong et al., 2004; Zanella et al., 2005). In many fruit-producing countries, the HarvestWatch™ system is now known as 'DCA' (Dynamic Controlled Atmosphere) because it is being used to detect the lowest acceptable oxygen concentration through the entire storage season (Fig. 7). Recent research in Switzerland by Gasser et al. (2008) has shown that the onset of undesirable anaerobic fermentation (signalled by a sudden increase in CO_2) and the increase in the F_α signal are highly correlated. The HarvestWatch™ system also detects the combined effect of temperature and

Figure 6. An example of the effect of temperature and low oxygen stresses on F_α chlorophyll fluorescence in stored Honeycrisp apples showing that a decrease in temperature is associated with an increase in F_α. Segments A to D are different storage temperatures and the four arrows indicate a low oxygen stress event at each temperature. Temperature D (0 °C) is known as a chilling-injury inducing temperature for 'Honeycrisp' apple (adapted from Wright et al., 2010).



low oxygen stresses (Fig. 6). Note that the chlorophyll fluorescence visually suggests that there is a maximum total stress response. Thus, as the temperature stress increases (20 to 0 °C), the effect of a low oxygen stress appeared to decrease, as measured by chlorophyll fluorescence. Most interestingly, at 0 °C, which is known to cause chilling injury in 'Honeycrisp' apple, a low oxygen stress is barely detected, perhaps due to the overwhelming low temperature effect already being experienced. Many researchers have suspected this is what happens when environmental stresses are combined, but the HarvestWatch™ system is the first technology to demonstrate this stress synergism *in situ*.

The HarvestWatch™ system is combinable in real-time with O_2 and CO_2 gas concentrations and temperature measurements and monitored

Figure 7. An example of the F_α fluorescence signal detected in apples held at 20 °C in air (open circle) and in a progressively diminished oxygen environment (dark circle). The spike in F_α begins as the chamber oxygen levels fall below 1% at 72 h and continues upward until the oxygen concentration is increased at 84 h (Prange et al., 2003).

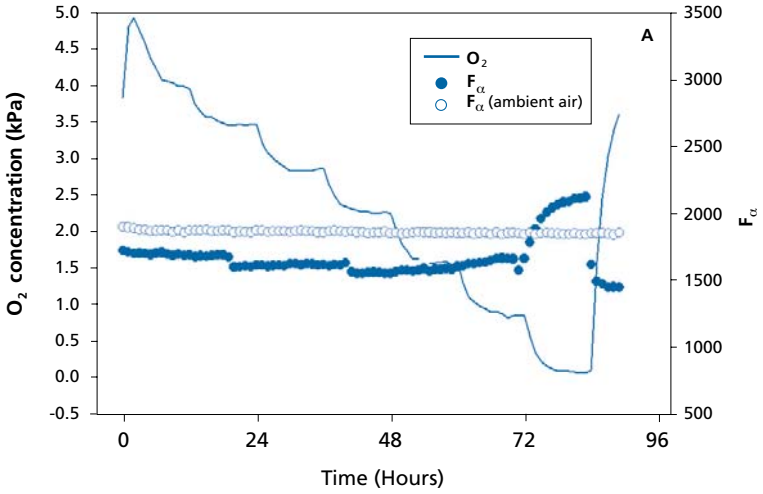
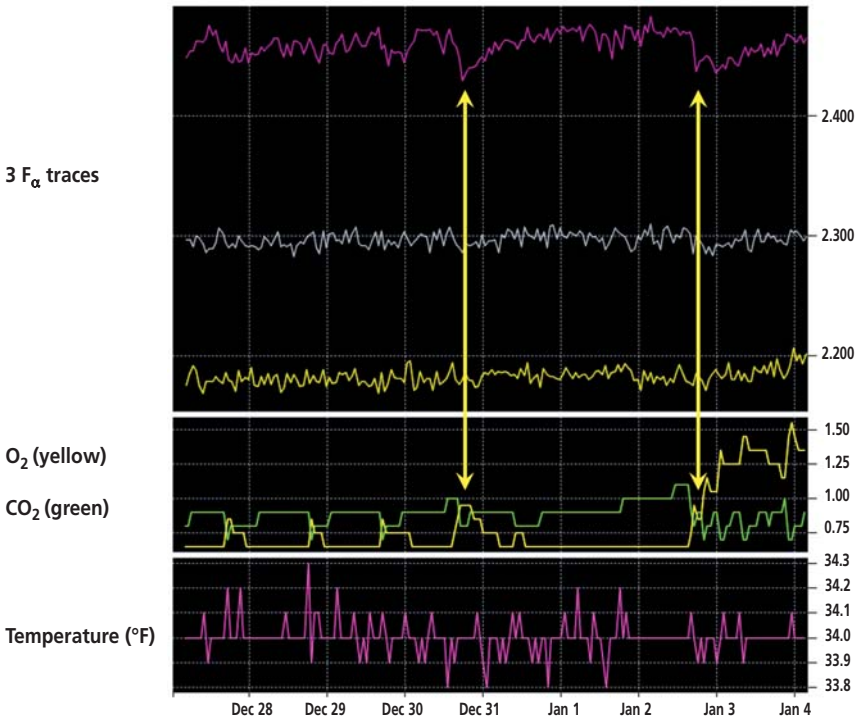


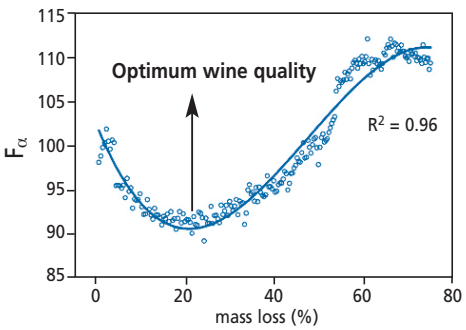
Figure 8. Example of real-time monitoring of a commercial DCA store room in Washington State. In this example, the two lowest raw F_α traces are stable (same cultivar). The uppermost F_α trace (different cultivar) is indicating a favourable response (drop) to the increase in O_2 gas level (yellow trace in the middle window) on Dec. 30 and again on Jan. 2. This suggests that this cultivar was sensitive to O_2 concentrations below ca. 0.75%.



remotely (Fig. 8). In this example from a commercial DCA room in Washington State, two apple samples (same cultivar), each under a separate fluorescence interactive response monitor (FIRM) sensor, were responding favourably to the DCA room conditions, whereas a second cultivar (uppermost F_α trace) was sensitive to O_2 concentrations below 0.75%.

The HarvestWatch™ system detects water loss after harvest, an important factor that affects the quality of fruits and vegetables (Bellincontro et al., 2009; Wright et al., 2008, 2009). Most fruits and vegetables should be properly handled after harvest to avoid dehydration. One interesting exception is the traditional method in Italy of slow-drying grapes ("Appasimento" method) in order to make high-quality wines. The optimum water loss threshold needed on these grapes is ca. 20% of the initial fresh weight (Bellincontro et al., 2009). The HarvestWatch™ system tracks the water (mass loss) of grapes in controlled laboratory conditions (Bellincontro et al., 2009; Wright et al., 2008, 2009) (Fig. 9). Often, there is a decline in chlorophyll fluorescence until about 20 to 30% mass loss. Thereafter, there is a reversal in the fluorescence signature suggesting the onset of stress. The reversal of the chlorophyll fluorescence signal between 20 and 30% appears to correlate with industry practice, confirming that there may be a measurable physiological basis for this practice. Thus, the HarvestWatch™ system could replace the cumbersome industry practice of repeatedly weighing the grapes until the 20 to 30% mass loss is achieved.

Figure 9. Example of changes in F_α chlorophyll fluorescence due to water (mass) loss in grapes after harvest. The decline in F_α continues until ca. 20% mass loss and thereafter it reverses. This reversal after ca. 20% mass loss correlates with the Italian industry's practice of making "appasimento-style" wine from grapes after 20% mass loss (adapted from Wright et al., 2008).



There has been a long-held belief that chlorophyll fluorescence is an interesting scientific phenomenon that is solely useful to scientists working with plant chloroplast physiology. The development of the HarvestWatch™ system of measuring chlorophyll fluorescence has moved this technology into practical applications. Since 2004, this system has provided a tool for the refinement of CA storage practices because it is the first successful real-time detector of the low oxygen limit in CA-stored apples and other chlorophyll-containing fruits and vegetables. Currently, it is estimated that 300,000 to 400,000 bins of fruit are stored using DCA technology, mainly in the North American and European apple industries, and it is increasing at a rate > 40% per year. In the future, it is conceivable that it will further improve fruit and vegetable quality non-chemically, by providing other critical information, e.g. detecting and controlling temperature and water loss stress effects.

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Commercial Micropropagation of Ornamental Plants in China

Qing Liu and Qinglin Liu

Of almost 300 species and cultivars of ornamental plants that can be micropropagated in China, about 100 have achieved commercial production. Due to the high cost and small scale of plantlet demand, commercial micropropagation is limited. Simplifying or substituting culture medium and plant growth regulators (PGRs), energy-saving environments, optimization of culture procedures, application of new culture systems and apparatus, and integrated cost control are possible ways to promote commercial micropropagation of ornamental plants in China.

The technology of plant tissue culture began in the early 1970s and developed quickly in China. At present, about 15,000 to 20,000 people in 2,500 to 3,000 enterprises are engaged in the tissue culture industry. Micropropagation systems for almost 300 ornamentals have been established of which 100 attained commercial production. Annual output of tissue-cultured plants has reached about 100 million, which accounts for 25% of vegetatively propagated propagules in China. As a country with rapid economic growth, China has large scale flower production, but the proportion of micropropagated plants is lower than global level, which means that the potential for tissue culture production in China is great. Of tissue cultured ornamentals, 63% are herbaceous, including annuals and biennials (3%), perennials (26%), bulbs (14%), orchids (6%), succulents (11%), and ferns (3%); woody plants represent 37%, including trees (12%), shrubs (22%), vines (2%), and bamboos (1%). Tissue culture of herbaceous plants is less difficult than that of woody plants, the cost is lower, and market demand is larger. The two most important categories for micropropagation are perennials and shrubs.

There is a long list of commercially micropropagated plants (Table 1), but the major species are *Phalaenopsis aphrodita, Dianthus caryophyllus* (Fig. 1), *Gypsophila oldhamiana, Gerbera jamesonii, Cymbidium grandiflorum, Oncidium luridum, Anthurium scherzerianum*, and some woody species such as *Eucalyptus* spp. and *Photinia fraseri. Dianthus caryophyllus, Gypsophila oldhamiana, Rosa* spp., *Aloe vera*, orchids (Fig. 2), *Gerbera jamesonii*, and *Sinningia speciosa* have been exported to Korea, Japan, the United States, Canada, and other countries.

Although micropropagation of ornamental plants has been widely researched, commercialization remains low in China for the following reasons. Firstly, the technology of tissue culture itself is not perfect. Hundreds of shoots or plantlets in a laboratory scale are quite different from millions of plantlets in commercial production, even with the same medium, the same plant growth regulator (PGR) combinations, and the same environmental conditions. Pilot testing is necessary prior to larger scale commercial production. Secondly, the market demand for each cultivar is limited. New floricultural crops and new cultivars are released every year and the demand for one cultivar or species is quite limited. Generally speaking, commercial micropropagation is profitable only when 100,000

Figure 1. *Dianthus caryophyllus* in vitro.

Figure 2. *Dendrobium* in beds.

Table 1. Main species and estimated commercial production of micropropagated ornamental plants in China.

Species	No. (000)	Species	No.
Phalaenopsis aphrodita	50000	*Acacia melanoxylon, Amygdalus triloba, Ananas comosus* (9 cvs.), *Anoectochilus roxburghii, Ardisia mamillata, Begonia rieger, Bougainvillea spectabilis, Caladium bicolor, Caryopteris clandonensis* 'Worcester Gold', *Cercis* spp., *Chlorophytum comosum, Codiaeum variegatum, Cotinus coggygria, Cyclamen persicum, Daphne odora, Dendranthema morifolium, Dracaena angustifolia, Ficus elastica, Freesia refracta, Fuchsia hybrida, Hemerocallis middendorffii, Hibiscus syriacus, Hippeastrum rutilum, Hosta plantaginea, Ilex purpurea, Jasminum nudiflorum, Lagerstroemia indica, Lavandula pedunculata, Lilium* spp., *Liriope spicata* 'Variegata', *Magnolia coco, Narcissus pseudonarcissus, Nepenthes mirabilis, Ornithogalum caudatum, Osmanthus fragrans, Paeonia lactiflora, Paphiopedilum* spp., *Pellaea ratundilalia, Populus hopeiensis, Prunus serotina, Rhododendron lapponicum, Robinia pseudoacocia, Saintpaulia ionantha, Strelitzia reginae, Syngonium podophyllum, Syringa oblata, Yucca filamentosa* (48 cvs.)	Less than 10 thousand for each spp., the total is about 500 thousands
Dianthus caryophyllus, Dianthus plumarius	18000		
Gypsophila oldhamiana, Gypsophila elegans	10000		
Gerbera jamesonii	7500		
Cymbidium grandiflorum (15 cvs.)	5000		
Foliage: *Cordyline fruticosa, Trachelospermum jasminoides, Philodendron erubescens, Monstera deliciosa, Maranta arundinacea* (5 cvs.)	5000		
Oncidium luridum	3000		
Aloe vera (12 cvs.), *Aloe arborescens, Aloe nobilis*	2000		
Anthurium andraeanum (10 cvs.)	1000		
Eucalyptus spp.	1000		
Photinia fraseri	1000		
Fern: *Adiantam capiuarisveneris, Nephnolepis cordifoolia, Davallia bullata, Nephrolepis exaltata* 'Bostoniensis', *Pteris wallichiana, Platycerium wallichii*	1000		
Prunus serrulata	500		
Succulents: *Kalanchoe blossfeldiana, Haworthia fasciata, Spathiphyllum pallas, Faucaria tigrina, Casteria batesiana, Haworthia cymbiformis, Haworthia comptoniana, Haworthia truncata, Haworthia retusa, Haworthia fasciata*	500		
Zantedeschia spp.	500		
Dendrobium spp.	200		
Populus tomentosa	100		
Rosa cvs.	100		
Sinningina speciosa	100		
Taxus ssp.	100		
Petunia hybrida	50	Total 90 spp.	107,150,000

plantlets of a single variety are sold. If the quantity of plantlets is less than one million, the price may be the same or even higher than that of cuttings or grafts. Thirdly, the research is not closely associated with production. Studies of tissue culture are generally conducted in universities or research institutes, while the production of micropropagation is carried out in small enterprises. There is a long path of technology transfer from universities to enterprises. We believe it is better for a larger enterprise to have its own scientific research or technological development team on plant tissue culture.

SIMPLIFICATION OF BASIC MEDIUM

There are dozens of basic culture media, such as Murashige and Skoog (MS), Murashige and Tucker (MT), Schenk and Hildebrandt (SH), and White and Chu's N6 media. The majority of ornamental plants were cultured on MS medium. Now more modified media have been researched (Tu et al., 2004). The media used in China are usually specific for each species, simplified, and environmentally friendly (Fig. 3). Substitution of medium components is an effective way to reduce costs. For example, distilled or deionized water can be substituted by boiled water (Chen, 1999; Qin et al., 2009). The latter costs only one third of the former, and a pH value of 6.0-6.5 is suitable for most ornamental species. Agar and carrageen are often used as coagulants in traditional tissue culture. But the roots are thin, weak, and brittle on that medium, and can be easily injured when transplanting, despite the high costs. Agars can be substituted by konjac glucomannan, which not only reduces the cost, but also increases the quality of rooted plantlets (Wu et al., 1999). The new coagulant composed of carrageen (4 g/L) and xanthan (0.5 g/L) costs 0.26 RMB (0.038 USD) L^{-1}, only one fifth of the cost of agar medium (Qu et al., 2009).

The simplified or substituted media are especially important in the rooting stages. Many rooting media including glass beads, glass wool, quartzite, foam, absorbent cotton, vermiculite, perlite, ceramic fiber, and plant fiber can be used as support material instead of agar. These media can improve the medium porosity, gas diffusion, and oxygen concentration, which are favorable for rooting. The recycled medium will have the same effects as fresh medium if 30% of fresh liquid is supplied in each period (about 25 days). This cheap method has been used in tissue culture of triploid *Populus tremula* x *P. tremuloides* (Dong et al., 1998, 1999).

In order to provide a dark environment for root growth, Wang (2006) developed a black alternative medium with 0.5-3.0 mg L^{-1} of turpentine soot ink, which is easily made, and the black color is well diffused. Black media have been used in commercial production of orchids. The orchid plantlets have more roots showing good morphologic features (Wang, 2006).

SUGAR-FREE MEDIUM

Sugar-free media have been applied in tissue culture of *Cymbidium grandiflorum, Dendranthema morifolium, Dianthus caryophyllus, Gypsophila paniculata, Gerbera jamesonii, Limonium sinuatum, Zantedeschia aethiopica, Anthurium andraeanum, Spathiphyllum pallas, Eucalyptus* spp., *Ornithogalum caudatum,*

Figure 3. Preparation of culture medium.

Populus tomentosa, and *Pinus radiata*. In the same conditions of light intensity and CO_2 concentration, healthy and strong plantlets with good roots can be obtained if cultured on MS medium without sugar (Wang, 2007). In rooting medium without sugar, the contamination rate is lower, the transplanting rate is higher, and there are more new leaves than when cultured in sugar medium (Gao, 2006). Rooting in liquid sugar-free MS + 0.3 mg L^{-1} NAA with floating substrates was found to be best in tissue culture of *Erigeron breviscapus* (Yang et al., 2007).

NATURAL EXTRACTS INSTEAD OF PGRS

PGRs play a key role in micropropagation of ornamental plants, because they regulate induction and differentiation of callus, adventitious buds, and roots. They are usually expensive, which greatly increases the costs of tissue culture. The PGR-free medium with bamboo-shoot syrup and agar can induce plant regeneration, because there are some amino acids, 6-benzyl adenine (6-BA), indoleacetic acid (IAA), and other hormones in the bamboo-shoot syrups. For germination, multiplication, and growth of buds, stems and roots, this medium is better than MS medium with PGRs (Jia et al., 1997). Both bean sprout juice and tomato juice are rich in vitamin B and C, which can increase callus induction. The rate of callus induction of *Davidia involucrata* reached 98% by adding 30 mg L^{-1} of bean sprout juice and 20 mg L^{-1} of tomato juice (Dong and Li, 2007). The combination of 6-BA, naphthalene acetic acid (NAA), and 1-3% of aloe juice could shorten the duration and increase the rate of bud induction in Rieger begonia (Zhang et al., 2008). Royal jelly (a secretion of the pharyngeal glands of worker bees that is rich in vitamin B, acetylcholine, amino acid and hormones) with a similar effect of auxin and cytokinin can induce the callus differentiation and promote root growth (Jiang and Pan, 1992; Jiang et al., 1998).

TEMPERATURE

Different ornamental species require different temperatures. For example, low or alternative temperature is suitable for bulb flowers. For the same species, the temperature requirements for subculture, rooting, acclimatization, and transplanting often differ. The temperature for proliferation is higher, but constant temperatures of 25-30°C are usually provided. According to the temperature requirements of different species for different stages, accurate control of temperature gives the greatest savings. Meanwhile, making full use of natural conditions is energy-saving and environmentally friendly. For *Gerbera jamesonii*, the natural temperature and solar radiation can fully meet the needs of tissue culture during late spring to early summer and late summer to early fall (Wang et al., 2006).

ILLUMINATION

Incandescent lamps are commonly used in micropropagation. Some new light sources have been used recently. Xu et al. (2001) pointed out that the thulium fluorescent lamp is the ideal light source for tissue culture. Wu et al. (2007) found that the fresh weight and chlorophyll content were higher under light-emitting diode (LED) than under fluorescent lamps. Using LEDs can reduce energy consumption and enhance plantlet quality in *Ilex purpurea* and *Dendranthema morifolium* (Fig. 4) (Xu et al., 2009). Not only the light source and density but also the light spectrum affect in vitro growth. For example, red light is propitious in induction of lateral buds in *Gypsophila elegans* (Wang et al., 2001), blue light can increase the callus induction in *Freesia refracta* (Che et al., 1997), and yellow light can restrain bud differentiation in *Euphorbia pulcherrima* (Jiao and Tie, 2003). Appropriate light spectra and intensities are necessary for different species at different stages. Roots often grow upward in vitro in chrysanthemum and lily. When the shelves are covered with two cloths, black on the top and white underneath, the roots grow downwards (Zheng et al., 2004).

CO_2

Increasing CO_2 can promote photosynthesis and plantlet development. Therefore the sugar consumption can be reduced in *Oncidium* by adding CO_2 (He et al., 2003). The CO_2 concentration is more important than moisture in growth of petunia (Qu et al., 2007). A real-time control system for CO_2 was developed and software was designed that can control ranges of CO_2 concentration (Ding, 2000). Systems and devices for photoautotrophic micropropagation have been used in commercial micropropagation of *Gerbera jamesonii* (Xiao et al., 1998). Environmental factors such as temperature, humidity, light, and CO_2 can be automatically and precisely controlled by computers. The system will provide a suitable condition for in vitro growth and promote commercial production of tissue-cultured plantlets.

OPEN CULTURE SYSTEM

An open system for tissue culture has been set up in China recently in which the artificial illumination, controlled temperature, and aseptic environment are replaced by open and natural surroundings. The key is the use of bacteriostatic agent extracted from plants, which is used for sterilization. This can be added directly to the medium instead of disinfecting or autoclaving, but the contamination rate could be kept under 10% without influencing the result (Cui et al., 2004). In an open environment, *Oncidium* 'Aloha Iwanaga' shoots grow well on glucose-free medium with 0.05% NaClO in

Figure 4. LEDs in trials.

Figure 5. Explant inoculation.

Figure 6. Acclimatization greenhouse in Kunming.

Figure 7. Transplanting greenhouse in Yinchuan.

enriched CO_2 conditions (Hua, 2005). In the open system, the plantlets are semi or fully photoautotrophic, while in vitro they are heterotrophic.

LIQUID SHALLOW-LAYERS

Liquid shallow-layers have been developed in which the plantlets grow well and quickly in commercial production. The ventilation is improved, the nutrients are added in time, and the substance is diffused completely. The effects of liquid shallow-layers have been studied in 16 ornamental species (Tan and Dai, 1986). In multiplication and rooting of *Begonia mannii*, the results are much better in liquid shallow-layers than in solid medium (Ma et al., 2004). What is more, the contamination rates are low, the plantlets are easily transplanted, and the costs are reduced.

CULTURE OPTIMIZATION

Stage I: Establishment of Aseptic System

The disinfection of the explants is most important during this stage (Fig. 5). Disinfectants such as mercuric chloride, bleaching powder, sodium hypochlorite, and alcohol are often used. The residues of these substances on explants will affect induction and growth of initial calluses or buds. Using magnetic fast stirring apparatus can reduce the browning rate (Xiao et al., 1999).

Stage II: Subculture and Proliferation

The key to realize maximization of proliferation is the subculture cycle. The cycles of different species and varieties are different. For example, the best proliferation cycle of *Gerbera jamesonii* 'Clementine' and 'Fougo' is 25 to 30 days, but 30 to 35 days is good for 'Terranera' and 'Shanghai' (Wang et al., 2006). In order to maintain genetic stability, the subculture frequency should not be too great. The optimum subculture frequency of *Gerbera jamesonii* is generally 4 to 5 times (Liao et al., 2005). When the proliferation rate decreases and adventitious buds grow weak, it is better to change the cultural conditions or re-establish the aseptic systems.

Stage III: Rooting

By combining rooting ex vitro with acclimatization, the survival rate of transplanted plantlets can be raised. It has been widely used in micropropagation of *Gardenia jasminoides* (Zhao, 2006), *Aloe vera* (Xing, 2000), *Cunninghamia lanceolata* (Gao, 2006), *Gerbera jamesonii* (Wang et al., 2006), *Gypsophila paniculata* (Wang, 2007), and so on. The suitable temperature for ex vitro rooting is 18-30°C, the optimum is 25°C, and the relative humidity is 80-90%. Under such conditions, the rooting plantlets can be cultured in perlite instead of common rooting medium (Huang and Yang, 2007). The ex vitro rooting technique with a filter paper bridge is carried out for liquid culture (Sun et al., 2001, 2002). The rooting rates of *Malus zumi, Populus* spp., *Sinningia speciosa*, and *Cymbidium grandiflorum* with filter paper bridges are 87-100%. At the same time, the survival rate can reach 95% and the costs decrease to 13.26% (Sun et al., 2002).

For ornamental species that root with difficultly, PGR concentration can be reduced before rooting or subcultured twice in the rooting medium. For example, if rhododendron plantlets are cultured on half woody plant medium (WPM) hormone-free medium one month before rooting, the rooting rate is increased and the quality of plantlets is improved (Liu et al., 2007). Adding chlormequat chloride (CCC) or paclobutrazol to the medium before transplanting may enhance plantlets (Gao, 2007).

Stage IV: Transplanting

The key to improving the survival rate is the quality of rooted plantlets and origin of adventitious roots. Roots originated from phloem are better than those from callus. Plantlets with short roots, thicker stems, and new leaves are superior (Fig. 6 and 7).

INTEGRATED COST CONTROL

The cost of tissue culture mainly includes chemicals (nutrients, PGRs, coagulant), water, electricity, labor, and depreciation of building and equipment (Ma et al., 2001). The cost analysis for orchid showed that labor, materials, depreciation, water and electricity account for 52.0%, 23.2%, 12.6%, and 12.2% of costs, respectively, which before transplanting account for 50% of the total cost (Wu et al., 2009). The cost of transplanting was the highest, about 51.6% in lily micropropagation (Leng, 2002). The importance of Stage IV and skillful labor is vital. For annual production of about one million plants, labor, electricity, and media account for 48.1%, 23.8%, and 4.4% of the total costs, respectively (Wang et al., 2005). Improving labor efficiency is key to cost control. The energy consumption could be decreased by more than 30% by using energy-saving lamps, natural light, and improved culture vessels (Mo et al., 2008).

It is necessary to raise labor efficiency and seedling output for cost control in micropropagation. For the plants themselves, the key to commercialization is to enhance the effective rate of proliferation and the survival rate of transplanting. When the proliferation rate is 3.0-5.0, every shoot grows strong and roots easily; otherwise, many small shoots will be discarded. The best method is to reduce the total amount of PGRs. Strongly rooted plantlets are essential to increase the survival rate during transplanting. There are many ways to promote rooting, such as sugar-free culture, ex vitro rooting, improved ventilation, and acclimatization in vitro. A digital micropropagation platform has been built up by combining digital, multimedia, network, and object-oriented programming with micropropagation; the technology is improved, efficiency increases, and intelligent management is realized on this platform (Xu et al., 2008).

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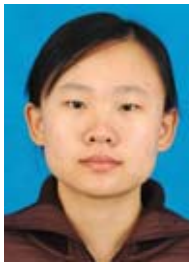

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The Migrations of Ornamental Plants

Judith Taylor

Globalization in business and communications is of considerable interest and frequently discussed but globalization of another sort, that of ornamental plants, has received modest attention. All over the world large public parks and small residential properties contain bedding annuals and perennials which have become commonplace and ubiquitous. This horticultural standardization belies the fact that most of the plants are of diverse origin yet appear to be naturalized in their adopted countries. Most gardeners have no idea that their plants originated somewhere else. The preponderance of goods for sale at garden centers is of exotic material. The growth and development of modern horticultural commerce depend on this phenomenon.

Ornamental plants found most commonly are the impatiens from East Africa via Central America, the begonia from temperate and subtropical sections of Asia and South America, the petunia from South America, and the pelargonium from the western part of the Cape of Good Hope in South Africa, a Mediterranean climatic region. Tulips from Western Asia and Southern Russia and narcissi from Southern Europe are popular bulbs in countries around the world. There are also plants from tropical and subtropical lands such as camellia or azalea which do well in temperate zones and many from alpine habitats which flourish in the lowlands such as poppies and primula. Roses survive far from their primary habitats in subtropical regions.

Floral colonization is at work. The very nature of the pleasure garden changed in response to the arrival of adaptable plants from around the world which were equally effective in small clusters or large agglomerations (Fig. 1 to 5). The concept of bedding was born.

MOVEMENT OF ORNAMENTALS

This invasion of ornamental plants was not a static process but took place in several overlapping phases. At first the bulk of the migrations were to Europe. Plants converged there both from the East and the West. These movements fluctuated by century. In the early modern period, the first agents of change were soldiers and adventurers. They were followed by traders and missionaries. Purely scientific exploration came much later. Private collectors dispatched specifically for the purpose of finding new plants to sell profitably formed a distinct chapter in this saga. The prime example of this phase was the concerted collection of orchids.

In the 18th century many new and previously unknown plants were going from North America to Europe. At the same time large numbers of European plants were going in the opposite direction. By the mid 19th century almost all the Eastern and Southern plants which had reached Europe moved on to North America. In both Europe and the United States, gardeners from 1870 on could furnish their plots almost exclusively with exotic plants.

Many national floras now tend to resemble each other quite closely. Even the earliest gardeners' guides contained both exotic imports and native plants without any comment. A list compiled from sources in England before 1600 revealed 30 plants of North American origin. Going back even earlier, Abbot Aelfric of Eynsham in Surrey put together a list of 900 "English" plants in the 9th century half of which had come from Europe and West Asia several hundred years before. He had no idea.

As humans move from one place to another, they carry plants and seeds with them. Queen Hatshepshut of Egypt sent her slaves to the Land of Punt to bring back frankincense trees and new ornamentals in about 1500 BCE. Alexander the Great in the 5th century BCE defeated the Persians and reached India, bringing back new plants to the cities he founded. The Age of Exploration in the 15th and 16th centuries opened up a mass exchange of plants. In the 20th century unscrupulous collectors wreaked such havoc in their zeal to outmaneuver their competitors that some species were on the brink of extinction and now international treaties have been established to protect the rights of countries to protect their own plant resources. The encroachment of exotic ornamental plants into native floras is an issue that

Figure 1. Ornamental plants from Africa: (A) gladiolus endemic to the Cape of Good Hope, South Africa; (B) pelargonium endemic to the Cape of Good Hope; (C) impatiens endemic to East Africa and South Africa; (D) kniphofia endemic to South Africa.

Figure 2. Ornamentals from the Americas. (A) dahlia endemic to Mexico; (B) fuchsia endemic to Central and South America; (C) petunia endemic to South America; (D) helianthus endemic to North and South America.

has received recent attention with concerns over invasive species.

TRACKING THE MIGRATIONS

In order to evaluate quantitatively the extent of infiltration by exotic plants into the flora of the United States, an analysis was made of the popular *A - Z Encyclopedia of Garden Plants*, published in 1997. This encyclopedia was originally a publication of the Royal Horticultural Society edited by Christopher Brickell and the late Judith Zuk. There are several excellent compilations of this sort but no other text so systematically lists the country of origin of the different species. In 2004, the encyclopedia was updated by Christopher Brickell and Marc Cathey for an American edition sponsored by American Horticultural Society, but was little altered. A further revision is scheduled in the near future. The encyclopedia is testament to the concept that the floras of the United Kingdom and the United States are so commingled one encyclopedia serves both countries with very little modification.

The encyclopedia has about 15,000 entries consisting of both hybrids and species. Approximately 6700 of the entries are for species only. A database was created for the species plants only using fields of the common name, the Latin name, the continent and country of origin, and any other significant fact which needed recording. This database made it possible to sort by country of origin. If there were any doubt about the species status of a plant the entry was omitted from the database, thus the final tally is less than the initial estimate of species in the work.

About 83% of the flora in United States commerce had a foreign origin (Table 1). Asia supplied about 30% of all imported plants. 10% were from China alone. Europe was the source of 19%, Africa of 12%, the majority from

Figure 3. Ornamentals native to Asia: (A) chrysanthemum endemic to Japan; (B) hemerocallis endemic to China, Japan, and Korea; (C) hosta endemic to China, Korea, and Japan; (D) Rose, the majority of species endemic to China but also found in other Northern temperate zones.

Table 1. Origins of garden plants grown at present in the United States (Taylor, 2009).

Location	No. species	Comments
Asia (including China)	1878	China: 663 species
Europe	1222	
North America (including Canada)	1122	Canada: 7 species
Africa (including South Africa)	770	South Africa: 453 species
South America	631	Brazil: 215 species
Mexico	348	
Australia	298	
New Zealand	190	
Total	**6111**	

Figure 4. Ornamentals native to Europe: (A) campanula endemic to Southern Europe and Turkey; (B) narcissus endemic to Southern Europe; (C) dianthus endemic in Southern Europe; (D) crocus endemic in Eastern and Central Europe.

South Africa. South America supplied about 10%, about a third of those from Brazil. Mexico was the source of about 5%. Australia and New Zealand combined sent about 8%. Set against this the 17% found in North America itself of which Canada provides only seven species.

TRANSFER TO THE UNITED STATES

Tracing the influx of ornamentals into the United States over the last century was made possible by an analysis of the horticultural census statistics starting in 1890 using data compiled by the U.S. Department of Agriculture (USDA) on plant sales and volume. The USDA counts ornamentals the way the Commerce Department counts noses. It was quite clear that the largest US sellers, in dollars, and the largest numbers (in units of sale) were for plants of foreign extraction. This was true of flowering trees, shrubs, herbaceous plants, annual and perennial, as well as for vines and other climbers. Large shade trees such as oaks are purchased much less frequently. The aggregate volumes of sales and numbers increased as the decades passed, to the present volume of about 6 billion dollars.

In its floriculture statistics USDA also collects information about the horticultural industry. It follows trends in both "finished" and "unfinished" merchandise. "Unfinished" means that the seedling is sold before it has matured and the purchaser then carries it through to maturity. Staffing ratios and other overhead expenses of any large operation grossing more than $100,000 per annum gross are also tracked. It is a very comprehensive system. The specific details of all this may be found in the appendixes of *The Global Migrations of Ornamental Plants: How the World Got into your Garden* (Taylor, 2009). The increases in dollars and volume could be followed for each decade. It appears that more foreign plants were being grown in the US than native ones by about 1870. Recognizing this trend may have led the USDA to start its census program.

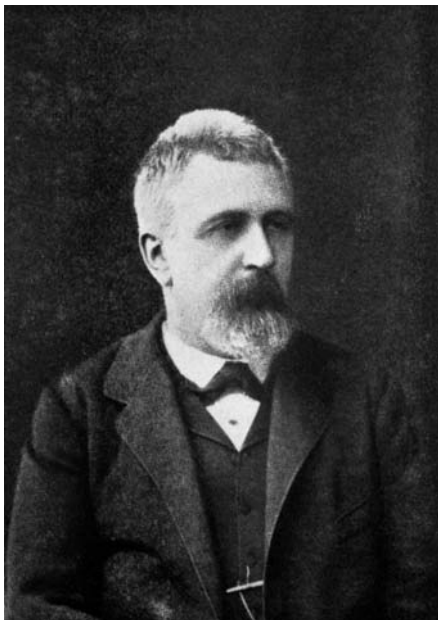
The first United States Secretary of Agriculture, from 1885 to 1889, was Norman Jay Colman, twice president of the American Association of Nurserymen (AAN). The association was a very powerful group in that period. Colman initially wanted to count the number of nurseries and greenhouses in the country. He was assisted by J. Howard Hale, president of the AAN in 1890 and 1891. Floriculture also attracted the attention of the Bureau of the Census. Another very important group at the time was the Society of Florists. Its leadership came from the nursery world and was guided by an interest in the stock it sold.

THE CHINA CONNECTION

China is a key part of the story. European explorers and botanists had three centuries of experience in China starting with the exploration of James Cunningham in 1698. The westward movement of Chinese plants was a trickle at first but became a deluge by the mid 19th century. An exemplary botanist named Emile V. Bretschneider (1833-1901), physician to the Russian Legation in Beijing, turned out to be the key to the story (Fig. 6). Remarkably, Bretschneider, a Russian from Latvia of German extraction, seems to have written in English; there is no mention of a translator. He published

Figure 5. Ornamentals native to Oceania: (A) ptilotus endemic to Australia; (B) scaevola endemic to Australia and Polynesia; (C) New Guinea impatiens endemic to New Guinea; (D) *Grevillea banksia* endemic in Australia.

Figure 6. Emile V. Bretschneider. Photo courtesy of Hunt Institute for Botanical Documentation.



a unique monograph on this topic in 1898 with much first hand detail. Little escaped his eagle eye and he seems to have left nothing out. Even the most minor European encounter with China was recorded and all the plants sent back to Europe by each collector were listed. However, the mother of all books about European botanists in China and their discoveries needed decoding. Bretschneider told his story chronologically and systematically but the lists of plants were quite randomly organized. This was overcome by turning his 1000 page book into another database. Sorting this information by collector and country demonstrated that Chinese plants began arriving in the main European capitals in steadily increasing numbers starting from 1700.

IMPACT OF PLANT MIGRATIONS

The modern science of botany, as distinct from simple natural history, grew out of this influx of new plant material, principally at first from the New World and subsequently from the rest of the globe. The endowed chair in botany at Oxford University, established in 1671, predates the endowment of chairs in other individual sciences. The development of botanical and horticultural institutions and publications also followed the arrival of the exotic plants.

In Great Britain, Sir Joseph Banks recognized the immense value that foreign flora contributed to the advancement of British industry and status in the world. King George III was quite sensible and intelligent despite his attacks of porphyria. He appointed Banks to take over a small royal property on the banks of the River Thames, Kew Gardens. For 40 years Banks unerringly made excellent decisions about men and plants, building Kew into the important institution it later became. Banks had accompanied Captain Cook on his voyage to Australia in 1769 and seen for himself the extraordinary flora of the Southern Hemisphere. It was Banks who named Botany Bay.

After his death in 1820, Kew languished. Fortunately a small private organization, the Horticultural Society of London, later the Royal Horticultural Society, formed in 1804, had enough strength to fill the gap left by the loss of Banks. The shrewd men who formed the society saw that the failure of Kew was a terrible error and supported the appointment of Sir William Hooker to be its director in 1840. This too was a seminal appointment. Sir William and afterward his son Sir Joseph were both far seeing and energetic men of prodigious industry.

At about the same period in the United States, the Massachusetts Horticultural Society and the Pennsylvania Horticultural Society as well as the American Philosophical Society in Philadelphia were all formed in the wake of great increases in exotic imports. The United States supported at least three major world wide explorations as well as explorations of its own interior in the early 19th century. All these yielded new plants and required taxonomists to describe and name them all. The task was overwhelming and took four decades to complete.

In summary it can be seen that regional and national floras were infiltrated and eventually replaced in commerce by exotic plants from many parts of the globe. The transmigration of ornamentals greatly expanded and enhanced the gardens of the world as well as agriculture, horticulture, and the science of botany.

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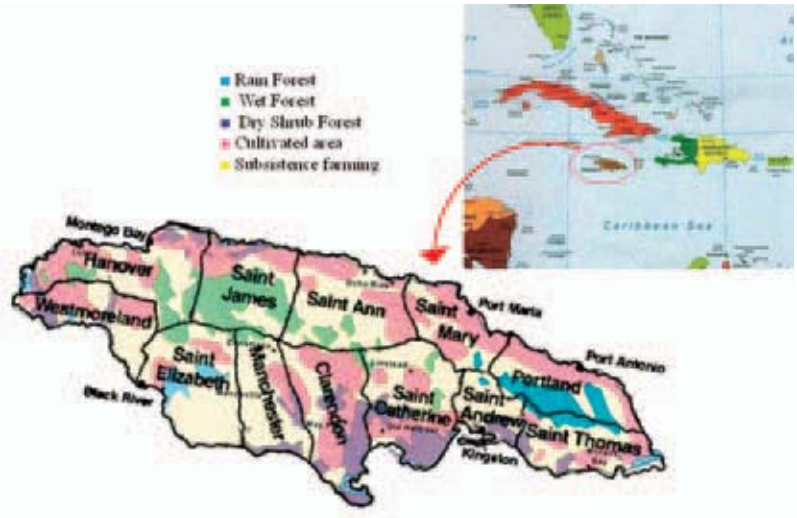
Horticulture in Jamaica

Noureddine Benkeblia

Agricultural production is an important contributor to Jamaica's economy and provides nearly 25% of the country's employment. Although sugar is the nation's dominant agricultural export product, the country also produces banana, papaya, coffee, citrus, spices, pimento, cocoa, coconut, as well as many other exotic fruits for domestic consumption. Agricultural production is subject to the region's tumultuous weather, mainly seasonal hurricanes and occasional drought. Despite the increase of horticultural production, major foods consumed are imported, which keeps food prices high throughout the country. Jamaica, like many other countries, is very concerned about food security, thus rural development has become the primary area of focus in the current agricultural and horticultural development programs.

Figure 1. Jamaica location and its different parishes and land geography.



INTRODUCTION

Jamaica (Fig. 1), which is the largest island of the Commonwealth Caribbean and the third largest of the Greater Antilles after Cuba and Hispaniola, is an island country in the Caribbean Sea (18° 15′ N, 77° 30′ W) located 628 km east of Central America's mainland, 150 km south of Cuba and 214 km west of Hispaniola (Haiti and Dominican Republic). Jamaica became independent in 1962, and its population is 2,780,000. With an area of 10,911 km^2, Jamaica is 235 km long, and it varies between 34 and 84 km wide. The country can be divided into three landform regions: the eastern mountains, the central valleys and plateaus, and the coastal plains. The highest area is that of the Blue Mountains, and the highest point is Blue Mountain Peak at 2,256 m. Two types of climate are found in Jamaica: an upland tropical climate prevails on the windward side of the mountains, whereas a semiarid climate predominates on the leeward side. The rainfall, much greater in the mountain areas, is heaviest from May to October and averages 1,960 mm per year, but exceeds 5,080 mm per year in the Blue Mountains. The southwestern half of the island lies in the rain shadow of the mountains and has a semiarid climate, receiving about 760 mm annually. Although mainly for domestic market, horticulture in Jamaica has tremendous potential to become a very profitable enterprise in the near future, particularly fruits and ornamentals production.

In Jamaica, the agricultural sector is the third economic growth driver, after services and manufacture and mining, and an important contributor to the economy (Tables 1-3). Agriculture contributed 7.4% to the GDP in 1997, 7% in 2000, and 5.9% in 2006. Despite this small and declining contribution to the national economy, agriculture absorbs almost 25% of the country's employed labor force. Agriculture also provides primary products for agro-industries, mainly sugar and rum manufacture, which accounted for approximately 20% of exports in 2004. Although Jamaican agriculture has a great potential to expand, it does not cover the national needs for agricultural products since a rising proportion of fruits and vegetables are imported from the Caribbean regions, USA, and Canada.

Jamaican total agricultural land (suitable for cropping) surface is 512,300 ha, 46.3% of the total land area. This figure includes cropped agricultural land (92%), natural forest (6%), and uncropped land (2%). The Useful Agricultural Area (UAA) was estimated at 85.6% of the total agricultural surface area (in 2002), while the farmed UAA is estimated at 247,878 ha (48.4% of total agricultural land area). More than 75% of the country has a slope of 10° or more, which severely limits its potential for agricultural production. Over half (53%) of the total 512,300 ha is only suitable for forestry cropping. A further 10% is considered suitable for tree crops and pasture with "extreme shortcoming for cultivation"; 36% is suitable for farming but with "strong or moderate" limitations, leaving only 3% usable with no limitations. Soil erosion is a major issue, as these sloping areas are planted mainly with cash crops, which provide minimal soil cover. Furthermore high rainfall exacerbates soil erosion and excessive nutrient depletion. The difficulties become even more apparent considering that the average small farmer is elderly with low literacy and rooted in traditional ways (Jamaica's Ministry of Agriculture). Smallholders represent 82% of the total number of farmers, yet account for only 16% of the total land area under agriculture. Most of these farmers cultivate land in the watershed areas on steep, highly fragmented land. The development of agricultural production was variable during this decade (Fig. 2).

Table 1. Area in farming in Jamaica (data of 2007).

Item	Land area (ha)
Total land area	1,099,356
Agricultural land	512,300
Active farmland	202,727
Crops	154,524
Pasture	48,203
Irrigated cropland	46,619

Table 2. Harvested area of major crops produced in Jamaica (2003-2007).

Crop	Harvested area (ha)				
	2003	2004	2005	2006	2007
Avocado *	530	530	530	530	530
Banana *	14,500	15,500	15,500	15,500	15,500
Cassava	898	910	750	951	992
Coconut *	51,000	51,000	51,000	51,000	51,000
Coffee, green *	5,600	5,600	5,600	5,000	5,000
Ginger	133	145	152	107	105
Lemon and lime *	2,450	2,450	2,450	2,450	2,450
Maize	1,659	1,352	1,535	1,541	1,399
Maize (sweet corn) *	5	5	5	5	5
Orange *	14,000	14,300	14,300	14,300	14,500
Papaya	427	343	399	499	430
Pineapple	1,031	901	682	921	807
Plantain	1,135	1,032	520	1,256	1,098
Potato	450	416	495	513	455
Roots and tubers	1,045	910	849	1,024	1,015
Sugarcane	30,600	30,900	27,600	30,000	30,800
Sweet potato	1,400	1,158	1,535	1,653	1,576
Tangerine, mandarin, clementine *	1,500	1,500	1,500	1,500	1,500
Yam	9,174	8,563	7,109	7,431	7,235
Total	**137,537**	**137,515**	**132,511**	**136,181**	**136,397**

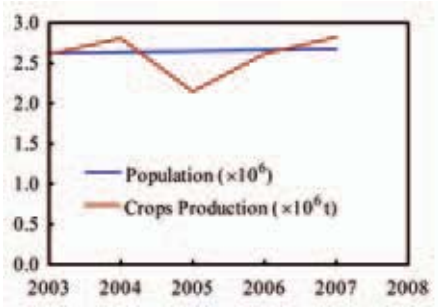
* Estimated value. FAO

Table 3. Major crops production in Jamaica (2003-2007).

Crops	Crop production (t)				
	2003	2004	2005	2006	2007
Avocado	4,000	4,000	4,000	4,000	4,000
Banana *	115,000	125,000	125,000	125,000	125,000
Cassava	17,248	16,758	13,224	17,711	18,519
Coconut *	265,600	265,600	265,600	310,500	311,000
Coffee, green *	2,820	2,400	2,400	2,700	2,700
Ginger	402	361	702	259	241
Lemon and lime *	24,000	24,000	24,000	24,000	24,000
Maize	2,029	1,591	1,926	1,894	1,674
Maize, green *	6	6	6	6	6
Orange *	137,000	140,000	140,000	140,000	142,000
Papaya	9,646	7,618	8,844	11,300	9,201
Pineapple	20,571	19,267	14,551	20,533	18,102
Plantain	20,189	17,760	8,953	21,986	19,087
Potato	6,710	6,504	7,729	8,559	7,477
Roots and tubers	18,354	15,679	14,351	17,914	17,315
Sugarcane	1,775,700	1,993,100	1,368,700	1,745,300	1,968,000
Refined sugar	146,750	167,720	113,115	143,806	162,977
Sweet potato	23,595	18,639	25,237	27,468	26,055
Tangerine, mandarin, clementine *	15,000	15,000	15,000	15,000	15,000
Yam	152,238	136,167	107,295	123,005	113,124
Total	**2,608,079**	**2,809,450**	**2,147,518**	**2,617,135**	**2,822,501**

* Estimated value. FAO

Figure 2. Evolution of crop production and population during the last five years in Jamaica.



MAJOR CROPS

In Jamaica, traditional agriculture includes sugar, banana, papaya, coffee, cocoa, citrus, pimento, yam, and vegetables. Sugar and banana are the most important, and both banana and coffee experienced significant increases in production during the last decade.

Cane Sugar

Sugar has been the dominant crop in Jamaica for centuries and in the late 1980s, sugarcane fields covered over 25% of the total agricultural area and employed about 18% of the total work force, although that demand was seasonal (Fig. 3). Refined sugar production including rum accounted for nearly 50% of agricultural export earnings in the early 1980s. Unfortunately, sugar production declined sharply from 514 450 t in 1965, and 60,000 ha of cane fields in production, to 193,000 t in 1984, with only 40,000 ha in production. Many factors contributed to the declining fortunes of sugar, such as the drop in world prices, falling yields, reduction in quality, labor unrest, and

Figure 3. Sugarcane field in Clarendon parish. (A) Pivot irrigation, (B) Harvested cane.

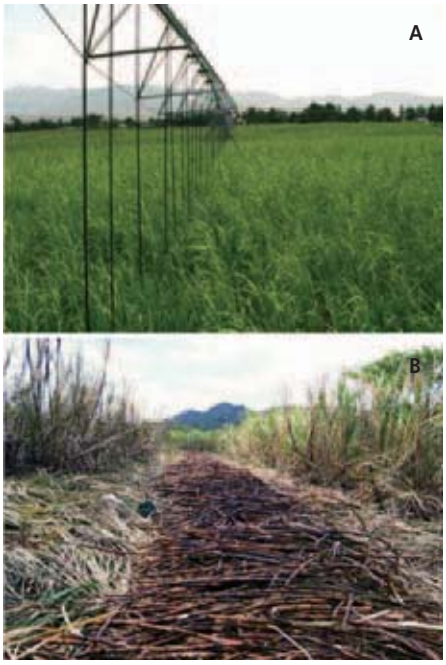


Figure 4. Banana culture in Jamaica.

refining factory inefficiency. Economically, sugar production accounted for just 0.1% in 2005; the contribution to export earnings has fallen from 49% in 1952 to 1.8% in 2006, while contribution to GDP has fallen from 9% in 1953 to 0.8% in 2006, an economic disaster. The bulk of Jamaican sugar is produced on large sugar plantations, while small and medium farms produce 30 to 40%. Productivity in the sugar industry is low due to outdated equipment and inefficient management. The large labor force needed to harvest cane sugar and the high competition of sugar beet were responsible for this decline. However, the state-owned Sugar Company of Jamaica Holdings Limited (SCJH) has commenced the upgrading of its remaining sugar factories to meet the 2010 crop by planting and replanting 1,500 ha of land, improving irrigation infrastructure and harvesting efficiency.

Banana

Banana was for times the major crop in Jamaica surpassing sugar in export revenues (Fig. 4). The main areas growing banana are Hanover, St. James, Portland and St. Thomas parishes, and 70% of the land under permanent crops in St. Vincent is devoted to banana cultivation, and 95% of all the banana produced in this parish are exported. However, production and exports were fluctuating and declined progressively. Production decreased from 136,000 t in 1970 to 33,000 t in 1980 and this decline was caused by diseases, such as the Panama leaf spot, which destroyed thousands of hectares of plantations, and many small-scale farmers had their crops entirely wiped out. Hurricanes also caused heavy damage to banana production. Although new disease resistant types such as 'Lacatan', 'Robusta' and 'Valery' were introduced, production up to the pre-war levels was never regained. Despite major efforts made by the government and farmers, production continued to decline and was only 11,100 t in 1984, considered the worst year in banana history. Several factors were responsible: slow technological advance, diseases, shortages of inputs, and natural disasters. Nevertheless, banana was typically produced by small farmers, and most farms growing banana grow other crops as well. Banana exports were destined for Britain, where Jamaica had preferential access for up to 150,000 t of its banana against non-Commonwealth nations. Restructuring in the banana industry developed large-scale banana farms, which allowed better pre- and postharvest handling of this crop. Jamaica's banana industry needs to focus on becoming more competitive. Moreover, farmers are being advised by the researchers to replace all 'Lacatan' with one of the other cultivars because they do not grow as tall and are therefore easier to handle when harvesting the fruit. The European Union (EU) is contributing to the development and diversification of the banana industry by improving the efficiency and profitability of the banana sector.

Papaya

Papaya was traditionally grown in the region and the scale of production is quite small (Fig. 5). The small papaya producers sell their fruits on the local market whereas the larger producers are involved in both growing and exporting operations. Papaya is mainly cultivated in St. Thomas and Trelawny parishes. There are many cultivars including 'Sunrise', which has a deep red flesh, 'Solo Sunrise', 'Kapahoe' from Hawaii, 'Maradol' from Mexico and 'Sunset' from Brazil. Only 'Solo Sunrise' is exported because of its qualities that match the commercial standard. Jamaica is the main regional exporter of papaya on a volume basis, but export is relatively new with only a few large producers. The largest grower has an annual exportable volume of 2,100 t per year and about 800 ha with 75-80% of trees in production. However, papaya is confronted by the tomato ring spot virus. The Jamaica Papaya Growers Association is working to develop resistant strains and develop export.

Figure 5. Papaya industry in Jamaica.

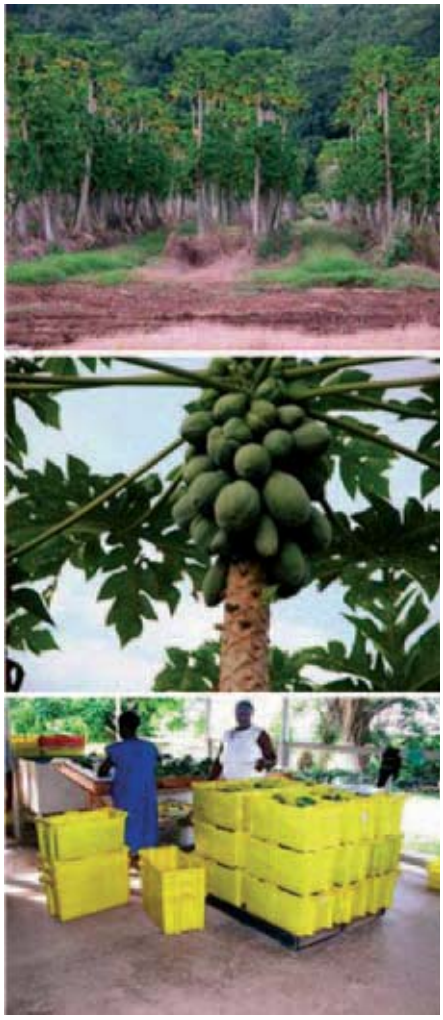


Figure 6. Citrus grove in Mandeville.

Citrus

Citrus (sweet orange, tangerine, grapefruit, and various hybrids) are usually grown on small farms, and the major part of this industry is located in the region of Mandeville (Fig. 6). Citrus production was quite stable in the early 1980s and many farmers harvested their own produce for the local fresh market. However, because of the high potential, larger-scale production was pursued, emphasizing processing for juices, concentrates, preserves, or canned fruit. Nevertheless, during the last decade, Jamaica citrus production decreased, with export declining by more than 60% and earnings dropping from US$4 to $1.5 million. At the present time production is consumed domestically as fresh fruit. A program of resuscitating about 4000 ha of citrus and establishing an additional 2083 hectares was launched in 2007 to aid in the recovery of the industry, which had been severely affected by a combination of the citrus tristeza virus disease that killed plants and reduced output, and drought. More recently, citrus huanglongbing (HLB), also known as citrus greening disease or yellow-shoot disease, was observed in Jamaica and although still limited presents a large risk for citrus. Jamaica needs to extensively replant its citrus groves, so that production might reach 150,000-190,000 t.

Coffee

In Jamaica, coffee has been cultivated since 1700 and at present is one of the most important export crops both for small and large farmers (Fig. 7). Lowland coffee is grown on small farms and accounts for more than 75% of total production, while the highland "Blue Mountain" representing 25% of production has

gained a larger share. In 1988, Hurricane Gilbert damaged 70% of the island's coffee fields and factories causing production to shut down for close to two years. However, as a result of considerable efforts, production has been restored to former levels and now exceeds 13,000 t annually. The area with Blue Mountain coffee doubled during the last two decades to over 2000 ha, but lowland's cultivation still remains stable. Coffee is the third most important Jamaican crop and exports are increasing by approximately 8% each year; the main destination of Jamaican coffee is Japan. The major growth constraint to the coffee industry is over-reliance on the Blue Mountain brand. The Jamaica Blue Mountain Coffee (JBMC) is a classification of coffee grown in the Blue Mountains located between Kingston to the South and Port Maria to the North, where the climate is cool and misty with high rainfall. The soil is rich with excellent drainage. This combination of climate and soil is considered ideal for coffee. This coffee is noted for its mild flavor and lack of bitterness. Although Jamaica does not have much of the world market in terms of production, the beans are well known for their exceptional quality and Blue Mountain coffee commands extremely high prices. Over the three last decades, it has developed a reputation that has made it one of the most expensive and sought-after coffees in the world. In addition to its use for brewed coffee, the beans are the flavor base of Tia Maria coffee liqueur. Thus, Jamaican coffee has exceptional prices relative to world prices; lowland coffee averages 2-3 times the world price, while the highly aromatic Blue Mountain coffee averages 4-5 times the world price.

Figure 7. Blue Mountain coffee plantation and beans.

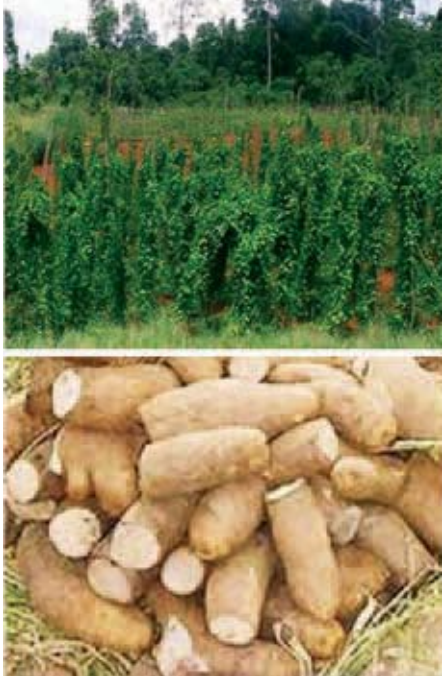


Figure 8. Growing and harvest of yellow yams in Jamaica.

Yam

Yam was brought from Africa and quickly became a staple food on plantations throughout the Caribbean, and today finds its way onto most Jamaican dinner tables. Up to 18 different cultivars of yam are cultivated in Jamaica. Most of these are grown in the parish of Trelawny and the most popular type is the yellow yam (Fig. 8). The parish of Trelawny accounts for up to 60% of Jamaica's yam production and approximately 50% of yams exported from Jamaica are grown in this area. Most exports go to West Indian communities in the United States, Canada, and UK. However, yam production decreased in 2007 to its second-lowest point in the past two decades, during which output peaked at 253,371 t. The value of yam exports was US$14.7 million in 2006, and US$15.5 million in 2007, and nearly US$19.94 million in 2008.

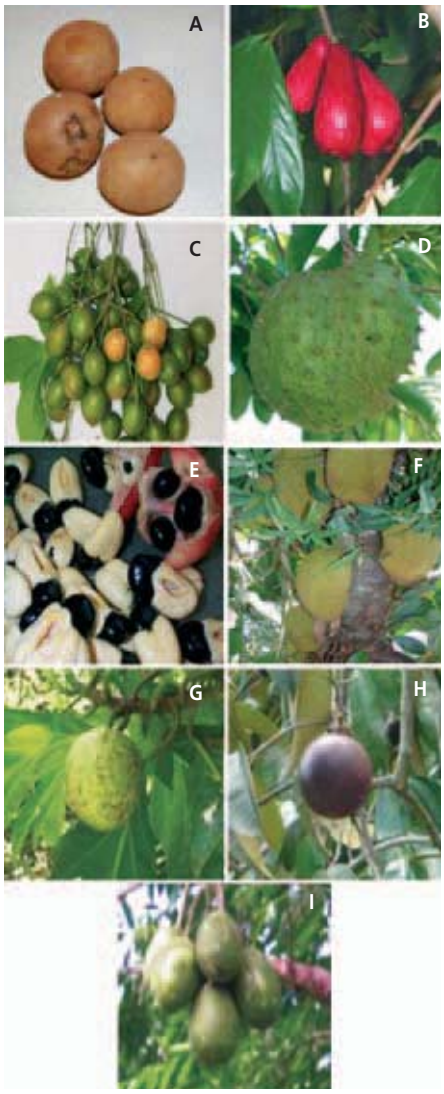
OTHER CROPS

Jamaica produces also a number of other traditional crops (Fig. 9), including cocoa, tobacco, coconut, pimento, ginger, ackee, jackfruit, breadfruit, otaheite apple, avocado pear, cerasse, hog plum, guava, guinep, jew (june) plum, mammy, mango, naseberry, passion fruit, pomegranate, soursop, starapple, sweetsop and tamarind. These many crops adapted to the country's tropical hot and humid climate are produced in small size farms. Although demand for exotic fruits is growing steadily, increased competition from other producers and a range of production and marketing problems are a considerable barrier for Jamaica to exploit these opportunities in full. Shipping is a major problem because these fresh produce have short shelf-life and need specific storage conditions.

AGRICULTURAL RESEARCH, EDUCATION AND EXTENSION

The University of the West Indies at Mona Campus in Jamaica, mainly the Agricultural Unit, Department of Life Sciences, the Biotechnology Center, as well as the Department of Chemistry and various Departments of the Faculty of Social Sciences, is a source of significant scientific advice and extension to Jamaica's agribusiness sector. However, more needs to be done for the sector to realize its full potential. Thus, agricultural higher education and advanced research programs are being developed by the Mona Campus. These programmes include education

Figure 9. The most common minor fruits of Jamaica. (A) naseberry, (B) otaheite apple, (C) guinep, (D) soursop, (E) ackee, (F) jackfruit, (G) breadfruit, (H) starapple, and (I) jew (june) plum.



of undergraduate and graduate students in tropical horticulture, agro-processing, animal science, research on endemic and other tropical crops of interest to Jamaica, and development of extension education and communication services. These programs will be focusing on two main areas: (1) greater cooperation and participation of professionals and farmers from different agribusiness sectors and, (2) enhancement of partnership potential by developing collaborative agreements and joint-ventures between the program partners and other academic and research institutes involved in tropical agriculture.

RECOMMENDATION FOR FUTURE DEVELOPMENTS

In Jamaica, agricultural production is mainly for domestic consumption but its increase is constrained by technical problems and drought. Despite the great opportunity for local food and crops production in Jamaica, most food for the island is imported, which keeps food prices high throughout the country. Jamaica, like many other countries, is very concerned about food security, and this issue as well as rural development have become primary areas of focus in the current agricultural development programs. To address these problems, several issues must be considered. First, the development of small scale farms must be addressed, since small farms require less input and employ more workers and more than 25% of Jamaica's population is involved in the agricultural sector. Instead of maintaining "mono-culture system", which was mainly based on cane sugar, Jamaica's agriculture should implement multi-culture cropping systems by developing promising crops such as coffee, papaya, yam and other tuberous crops. Second, to better regulate the market, either export or local, development of a co-operative marketing system would increase efficiency because it shortens the "route" of fresh produce from the farm to the consumer, and decreases "intermediaries", which are the main barrier for the good flow of produce and the cause of price increases. Third, the partnership between the different Caribbean countries should be developed further by increasing the produce quality. Jamaica is also making efforts to develop agricultural education as well as promote specific research fields such as biotechnology and applied sciences. The University of the West Indies at Mona would be an ideal partner for those outcomes by promoting and enhancing agricultural research activities.

References and Further Reading

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The papaya industry in CARICOM. Competitiveness & Industry Development Strategies. The CARICOM Regional Transformation Programme for Agriculture. January 2007.
United Nations. http://www.un.org/en/development/

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About the Author

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News from the IHC Lisboa 2010

IHC Lisboa 2010

The International Horticultural Congress is creating great enthusiasm all over the world. The on-line submission system has received 5000 abstracts for posters and oral presentations from 115 different countries. We thank authors for submitting such a high number of abstracts and the conveners and other people involved in the Congress organization for preparing an appealing program and for advertising this event so efficiently.

We apologize for some difficulties with the on-line submission system during the last few days before the deadline for submission but the computer system was literally flooded with abstracts at that time and almost broke down. Near one thousand abstracts were submitted in one day. To avoid this situation to happen again we recommend participants not to leave the Congress registration to the last days because it could be difficult to reply on time if our secretariat becomes congested again.

Now it is time for conveners and the scientific committees to select the abstracts and to organise the program of the various events. Poster presentations are encouraged as they will be a major form of scientific communication at the Congress. For the first time in International Horticultural Congresses authors have the possibility of presenting electronic posters. E-posters will increase poster visibility and the interaction with authors. Information about how to prepare and upload e-posters will be available on the IHC webpage. However, classic posters on paper will be the standard presentation format.

Inovisa, a specialised institution on technology transfer, will run a Horticulture Brokerage Event during the IHC. This event aims at promoting cooperation between researchers and stakeholders through pre-arranged business meetings using an on-line registration system. Check the IHC website for news about the brokerage event.

More than a mere scientific conference, the IHC hosts multiple activities that mirror the diversity of Horticulture with numerous events dedicated to the various crops and products and a wealth of disciplines and technologies. Have a look at the IHC website **www.ihc2010.org** to see what is going on because some happy surprises are on the way.

This is the Congress you cannot afford to miss. We are expecting to see you in August in Lisbon.

António Monteiro and Víctor Galán Saúco
Congress Co-Presidents

New Books, Websites

BOOK REVIEWS

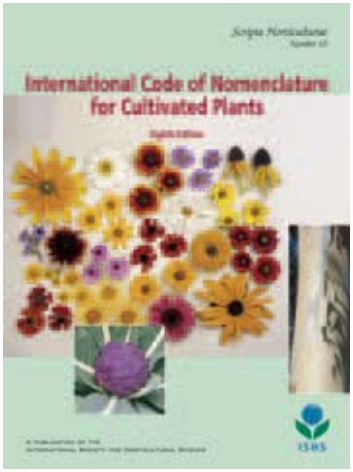
Following Chestnut Footprints (*Castanea* spp.) – Cultivation and Culture, Folklore and History, Traditions and Uses. Sulle Orme del Castagno (*Castanea* spp.) – Coltura e Cultura, Folclore e Storia, Tradizioni e Usi. Damiano Avanzato (ed.). 2009. *Scripta Horticulturae* 9. International Society for Horticultural Science. 175p. ISBN 978-90-6605-632-9. € 30. Available from the ISHS Secretariat (www.ishs.org/pub/scripta.htm).

The chestnut is a multifunctional resource in both Europe and Asia for food and timber, with a strong cultural history, considerable economic importance, and an important environmental role in agro-forestry systems. The nuts at one time were a dietary staple in Europe but have been transformed into holiday treat and gourmet item. Roasted chestnuts sold in the street are still a common sight in the winter in many cities. *Castanea* species are now found world wide. However, the chestnut has been proven to be a fragile genus due to the outbreaks of pests and diseases. In the United States for example *C. dentata*, the dominant species in broadleaf forests along the Appalachian range were decimated by chestnut blight and ink disease and the latter disease has also caused severe problems in Portugal. The success of the world industry will depend on advances in horticulture, genetics and breeding, and food processing.

This issue of *Scripta Horticulturae*, edited by Damiano Avanzato, Istituto Sperimentale per la Frutticoltura, Roma and Chair of the ISHS Section on Nuts and Mediterranean Climate Fruits, and assisted by the chestnut authority Giancarlo Bounous is the third in the series following similar ones on almond and pistachio, with each page divided into Italian and English versions. There are reports from 24 countries including two from Italy and a separate one for the Canary Islands. I was disappointed to see no report from Korea or Japan where chestnuts are important. Each chapter is divided into Historical background, Species and distribution, Economic and technical data, and Uses and tradition. There are a plethora of wonderful illustrations. This publication will be needed on the shelf of all chestnut workers.

Reviewed by Jules Janick, Purdue University, USA

International Code of Nomenclature for Cultivated Plants. Eighth Edition. C.D. Brickell, C. Alexander, J.C. David, W.L.A. Hetterscheid, A.C. Leslie, V. Malecot, Xiaobai Jin and J.J. Cubey (eds.). 2009. *Scripta Horticulturae* 10. A publication of the International Society for Horticultural Science. 204p. ISBN 978-90-6605-662-6. € 20. Available from the ISHS Secretariat (www.ishs.org/pub/scripta.htm).



The eighth edition of the International Code of Nomenclature for Cultivated Plants was prepared by members of the IUBS International Commission for the Nomenclature of Cultivated Plants at the end of the Fifth International Symposium on the Taxonomy of Cultivated Plants held at Wageningen, The Netherlands from October 15-19, 2007. During two days of meetings following the Symposium the Code Commission met to discuss and consider all the proposals made so that a further edition could be prepared and published to accommodate the changing needs of users. The editorial committee was composed of C.D. Brickell, (Chairman), C. Alexander, J.C. David, W.L.A. Hetterscheid, A.C. Leslie, V. Malecot, and Xiaobai Jin with assistance by Janet Cubey, Secretary. This edition is an essential sourcebook for nomenclature decisions in horticulture.

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

BOOK REVIEWS

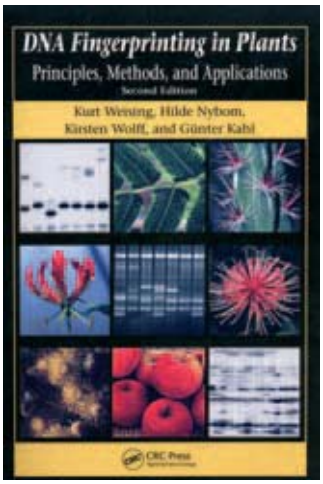
Discovering Indigenous Treasures: Promising Indigenous Vegetables from Around the World. Li-ju Lin, Yun-yin Hsiao and C. George Kuo. 2009. AVRDC – The World Vegetable Center, Shanhua, Taiwan. Publication No. 09-720. 317p. ISBN 92-9058-172-7. $35

This excellent handbook on indigenous vegetables contains information on 60 species (from *Amaranthus* spp. to *Zanthoxylum ailanthoides*) that are consumed as vegetables, most of which are indigenous to Asia. The short descriptions are authoritative and the many colored photographs for each species are stunning. There are helpful chapters on botanical features, environmental factors, production methods, and health values as well as a section (Nature's Palette) that includes ornamental uses and recipes. The list of references will be invaluable. The index is necessary to find individual species that are known under various names. This work will be useful for vegetable specialists and those interested in new crops.

Reviewed by Jules Janick, Purdue University, USA

DNA Fingerprinting in Plants: Principles, Methods, and Application. 2nd ed. Kurt Weising, Hilde Nybom, Kirsten Wolff and Günter Kahl. 2005. CRC Press, Taylor Francis Group, Boca Raton, Florida, USA. 472p. ISBN 0-8493-1488-7. $ 99.95.

Most of the first century of genetic studies relied almost entirely on phenotypes that were visible to the naked eye. Isozymes and some



other markers were more directly tied to specific proteins and biochemical activities. In the last 30 years a suite of techniques has been developed to measure directly the variation in DNA among individuals. This book provides an excellent review of these techniques as well as how the information generated by these methods can be used to address a variety of issues in plant science research.

The book can be divided into three technical sections that deal with DNA techniques to identify genetic variation, analytical methods to understand this information, and the application of these methods to plants, from analysis of genetic diversity and relatedness to the development of genetic maps. The first methods to study variation in specific DNA sequences used DNA hybridization techniques based on the Southern blot. These typically require a large amount of DNA and a collection of specialized equipment, are laborious and can typically deal with a small number of samples. Development of the polymerase chain reaction (PCR) opened the way to an almost bewildering array of simpler and more powerful methods to examine directly the variation in DNA sequences. Both older and more contemporary techniques are described in detail, but the emphasis is appropriately placed on the PCR based methods. The level of detail is likely sufficient to allow someone to get started on generating fingerprinting data, but guidance on how to troubleshoot problems is not included. However, the real strength of this book is the discussion on how to analyze and utilize the data. This is very welcome as it is now facile to generate molecular marker data, but making sense of this information is more challenging.

The speed with which new techniques in this field are developed is staggering, propelled by the demands of the medical sector for faster and cheaper methods that provide more extensive coverage of the genome. The cost of DNA sequencing is declining so quickly that "third generation" methods may well make obsolete many of the PCR techniques described in this book, as suggested by the authors as they look to the future. However, there will still remain many problems that are either not well suited to large scale sequencing, or where analyzing the data generated is too daunting. Consequently, this book is likely to remain relevant for studies on many horticultural species for a number of years.

Reviewed by Peter B. Goldsbrough,
Purdue University, USA

NEW TITLES

Ahuja, K.G., Nath, P., Swamy, K.R.M. (authors) and Gaddagimath, P.B. (ed.). 2010. Foods and Nutrition. Studium Press Pvt. Ltd., New Delhi, India. 485p. ISBN 978-93-80012-20-9. Rs. 2450. www.studiumpress.in

Benkeblia, Noureddine (ed.). 2009. Postharvest Technologies for Horticultural Crops. Vol. 2. Research Signpost, Kerala, India. 265p. ISBN 978-81-308-0356-2. $135. www.ressign.com

Birkás, Márta. 2008. Environmentally-sound adaptable tillage. Akadémiai Kiadó, Budapest, Hungary. 356p. ISBN 978 963 05 8631 3 (hardback). € 60. www.akkrt.hu

Cooke, Tony, Persley, Denis and House, Susan. 2009. Diseases of Fruit Crops in Australia. CSIRO Publishing, Collingwood, VIC, Australia. 288p. ISBN 9780643069718 (hardback). AU$150.00. www.publish.csiro.au

Dhankhar, B.S. and Singh, Ram (eds.). 2009. Okra Handbook - Global Production, Processing, and Crop Improvement. HNB Publishing, New York, USA. 475p. ISBN 978-0-9728061-8-3 (hardcover). $110. www.hnbpub.com

Ganzert, Joachim and Wolschke-Bulmahn, Joachim (eds.). 2009. Bau- und Gartenkultur zwischen "Orient" und "Okzident". Fragen zu Herkunft, Identität und Legitimation. (Building and Garden Culture between "Orient" and "Occident". Questions about Origin, Identity, and Legitimation). Martin Meidenbauer Verlag, München, Germany. 272p. ISBN 978-3-89975-173-4. € 44. www.m-verlag.net

Nyéki, József, Soltész, Miklós and Szabó, Zoltán (eds.). 2008. Morphology, Biology and Fertility of Flowers in Temperate Zone Fruits. Akadémiai Kiadó, Budapest, Hungary. 486p. ISBN 978 963 05 8591 0 (hardback). € 98. www.akkrt.hu

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

2010 Symposium of the BeNeLux Society for Horticultural Science - Challenges in Northern Wine Regions, 9 April 2010, Remich, Luxembourg. Info: www.beneluxshs.eu

EGEA 2010, 5-7 May 2010, Brussels, Belgium. Info: Agence pour la recherche et l'information en fruits et légumes frais, 60, rue du Faubourg Poissonnière, 75010 Paris, France, Phone: +33 (0)1 49 49 15 15, Fax: +33 (0)1 49 49 15 16, email: egea@interfel.com, web: www.egeaconference.com

3rd Green Med International Forum – The Euromed Fresh Produce Conference, 12-14 May 2010, Rome, Italy. Info: Ms. Eliana Rapisarda, Congress Manager, V. le Nino Bixio 1/A, 37126 Verona, Italy, Phone: +390458352317, Fax, +390458307646, email info@greenmedforum.eu, web: www.greenmedforum.eu

6th International Symposium on Peat in Horticulture – Life in Growing Media, 11 October 2010, Amsterdam, The Netherlands. Info: Gerald Schmilewski, Phone: +49 (0) 4492-8275, email: schmilewski@klasmann-deilmann.de, web: www.peatsociety.org

Section Banana and Plantain – Commission Plant Protection
Int'l ISHS-ProMusa Symposium: Global Perspectives on Asian Challenges

Panoramic photo of the Symposium participants.

The second joint ISHS-ProMusa Symposium 'Global Perspectives on Asian Challenges' was held in Guangzhou, China, 14-18 September 2009.

Close to 48 million tonnes of banana are produced every year in Asia, making the fruit one of the most important crops in the region. The fruit is part of the daily diet of Asians both as fresh fruit and processed delicacies, and plays an important role in the livelihoods of millions of banana growers who supply the local and export markets. The region, however, faces many challenges. Banana bunchy top disease has caused significant damage to the banana industry in many Asian countries over the last 20 years, and the recent outbreaks of tropical race 4 (TR4), a highly virulent race of Fusarium wilt, are extremely alarming. But there is also good news. Asia lies in the center of origin of the crop, and is home to a rich diversity of wild and cultivated bananas. This gene pool is a valuable source of genetic variability that has been the basis for crop evolution and is of vital importance for direct use by farmers or for breeding new varieties.

Group discussion led by the Musa Crop Improvement Working Group Chair, Dr. Mike Smith, and the ProMusa Coordinator, Dr. Inge Van den Bergh, at the workshop entitled "The role of genomics in banana crop improvement".

On the first 2 days of the symposium, researchers reported on how this diversity can be better explored and used to address major banana constraints. New tools for characterization of germplasm were described, and the application of these tools to unravel genetic relationships between species and subspecies as well as genome groups and subgroups was discussed. During the session, it was announced that the *Musa* genome sequence will be available in 2 years, and several presentations on the structure of the *Musa* genome were given. With new advances in biotechnology, useful genes can now be identified and molecular approaches will help make conventional breeding programs more efficient. In the second session of the symposium, scientists reported on the status of Fusarium wilt in Asia and discussed actions for raising awareness and preparedness in regions where TR4 has not been reported yet. New methods to study pathogen diversity and a diagnostic tool specific for TR4 were described. Several authors presented their work on host-pathogen interactions and evaluation protocols, while others reported on field management practices, including the use of resistant cultivars. The newly elected chair of the ISHS Section Banana and Plantain, Stephan Weise, closed the oral presentations with a keynote on linking agricultural research networks to innovation platforms.

Opportunities for bridging the gap between genomics and genetic improvement in *Musa* were further discussed in a workshop on the last day of the symposium. The participants identified access to germplasm as a central requirement, including the need for further conservation efforts (particularly of wild types and improved diploids), a strategy to deal with intellectual property rights and proper characterisation of the germplasm in terms of important phenotypic traits. Germplasm enhancement was identified as another area that needs attention, including the development of improved diploids and the identification of sources of genetic determinants of important traits, such as resistance to biotic and abiotic stresses, agronomic performance and post-harvest quality. Better ways to increase seed production from crossings and improve the results of embryo rescue need further attention. 'Ready-to-use' molecular marker technologies, such as markers unique to each genotype or to traits of interest, are seen by breeders as a first step in bridging the gap between breeding and genomics. Great progress in resistance breeding can be expected if information about genes for useful traits and alleles in diverse germplasm can be combined with molecular information gained on host-pathogen interactions, as well as pathogen diversity. Other genomic research areas identified by breeders are: whole-genome selection tools, increased knowledge of genetic determinants of important traits, polymorphisms for useful traits, gene discovery, participation in phenotyping/genotyping and pre-breeding, and information on pathogen diversity and host-pathogen interactions. New sites, in both banana-growing and non-banana-growing regions, for screening pre-breeding materials and hybrids are also required. These include screenhouses, greenhouses and closed facilities (e.g. growth rooms or chambers). For molecular biologists to have their work more directly applied by breeders, they would need: access to breeding populations (e.g. segregating populations), easier access to germplasm (mainly wild types), priority for traits (as it is difficult to pyramid genes for different traits: e.g. disease resist-

Dr. Agustin Molina, Bioversity International's Commodities for Livelihoods Regional Coordinator for Asia and the Pacific, speaking at the workshop entitled "Mitigating the threat of Fusarium wilt".

Dr. Yi Ganjun, Symposium Convener and Director of the Institute of Fruit Tree Research – Guangdong, welcoming the participants to the National Field Genebank for Banana, situated on the institute's grounds.

ance and increased yield) and more work to increase the diversity of parental lines by using a wider range of diploids that still need to be characterized and evaluated for important traits. Issues that were prioritized during a pre-workshop survey were shortlisted by participants during the workshop, and four areas were identified for further discussion: germplasm collection and characterization, phenotyping, molecular markers for gene discovery and for studying diversity, and identification of parents for recombination and cultivar development. In a side discussion, the need to promote existing and new banana breeding programmes in Asia mentioned in previous ProMusa meetings, was reiterated as a priority.

During a parallel workshop on Fusarium wilt of banana, a number of priorities for action were identified. A better knowledge of the basic biology, population biology and epidemiology of the pathosystem is urgently needed. This includes understanding the influence of edaphic and other environmental conditions on the outbreak and development of epidemics, pathogen survival in the absence of the banana host, alternative hosts, modes of pathogen dispersal including the potential role of insect vectors (if any) and aerial dissemination, and the potential value of soil amendments (e.g. silicon). The interactions between host, pathogen and environment need to be better understood. Two research groups announced ongoing efforts towards transcriptome and genome sequencing of multiple races of Fusarium wilt pathogens. This work will be instrumental in facilitating opportunities to increase our knowledge of Fusarium-banana interactions. Host-pathogen screening should be expanded, including testing of closely related resistant and susceptible germplasm. There is also a need to prospect for new, potentially resistant germplasm, and to characterize the pathogenic and genetic variability of Fusarium wilt races, clonal lineages and vegetative compatibility groups. The development of a standardized small-plant screening bioassay that can be adapted to local conditions as needed is considered an important starting point to accurately and reliably assess host response and pathogen virulence and facilitate comparisons across different geographical locations. Validation of such small-plant bioassays conducted under controlled conditions is needed to demonstrate that disease reactions are representative of field trials. Continental action plans to limit the movement of Fusarium wilt pathogens and prevent the entry of TR4 into Africa and the Americas need to be developed or further refined, and supported by effective public awareness campaigns, reliable diagnostic methods, and strict quarantine policies and procedures. The availability of a new TR4 diagnostic tool would facilitate surveillance in regions where the pathogen has not yet been found and would lead to more efficient identification and faster containment of uncharacterized Fusarium wilt outbreaks. Field evaluation of important cultivars from Latin America and Africa (e.g. plantain and highland bananas) in countries where TR4 is already present (e.g. Asia) should contribute to increased preparedness in TR4-free countries. More research is needed to identify reliable and efficacious options for inoculum reduction in soil, e.g. by using rotation crops, fumigation, solarization and biological control. Area-wide comprehensive IPM management programmes need to be better integrated, and more communication is needed between local companies and farmers. The community also needs to look into cost reductions for disease-free planting material, taking into account that tissue culture is not always an option. Workshop members also discussed the establishment of an international collection of Fusarium pathogens associated with *Musa* and the continued recognition of using strict biosafety protocols for the movement of pathogens.

In total, 58 talks and over 50 posters were presented during the symposium, which attracted over 80 Chinese and more than 100 international participants. The delegates also visited the Fruit Tree Research Institute of the Guangdong Academy for Agricultural Sciences (GDAAS) and a banana production area in Zhongsan where Cavendish (AAA) and Fen Jiao (ABB) cultivars are grown.

The symposium was hosted by the GDAAS and co-organized by them, Bioversity International, the International Society for Horticultural Science (ISHS) and ProMusa. Additional sponsors were the Science and Technology Department of the Guangdong Provincial Government (China) and the Agricultural Department of the Guangxi Provincial Government (China). The Technical Centre for Agricultural and Rural Cooperation (the Netherlands) supported several participants from African, Caribbean and Pacific countries, and the National Fund for Scientific Research (Belgium) supported the travel of a keynote speaker.

Inge Van den Bergh, Mike Smith, Nicolas Roux, Randy Ploetz, Alice Churchill, Augustin Molina and Yi Ganjun

Bioversity International's Commodities for Livelihoods Programme Director and newly elected Chair of the ISHS Section Banana and Plantain, Dr. Stephan Weise, making his closing keynote on linking agricultural research networks to innovation platforms.

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Fourth Int'l Symposium on Breeding Research on Medicinal and Aromatic Plants (ISBMAP2009)

Participants of the ISBMAP2009 Symposium.

Fifty-eight participants, coming from 23 countries of different continents (Europe, Asia, North America, South America) attended the 4th International Symposium on Breeding Research on Medicinal and Aromatic Plants (ISBMAP2009), held in Ljubljana, Slovenia, from 17-21 June 2009. The theme of this symposium has been dedicated to biodiversity conservation and use of medicinal and aromatic plants (MAPs) genetic resources. The meeting was organized jointly by the University of Ljubljana, Biotechnical Faculty and the Ministry for Agriculture, Forestry and Food of the Republic of Slovenia under the auspices of the International Society for Horticultural Science (ISHS). The event has been supported by the following sponsors: Slovenian Research Agency, Society for Medicinal Plant Research (GA), The Chamber of Agriculture and Forestry of Slovenia and SEEDNet. The Convener and Chair of the Organizing Committee was Prof. Dr. Dea Baricevic, Slovenia. The symposium programme was divided into 4 scientific sessions (Genetic Resources, Conventional Breeding, Biotechnology, Methods for Economising Breeding Procedures) that started each with keynote lectures, presented by five well skilled scientists in the MAPs area.

Prof. Dr. Ákos Máthé hands over an ISHS medal to Prof. Dr. Dea Baricevic, Convener of the ISBMAP Symposiun, Slovenia.

Within session Genetic Resources Prof. Dr. Kala (India) presented a well planned conservational programme for MAPs in India, with emphasis on the importance of indigenous knowledge for conservation of biodiversity. It has been stressed that for understanding of the species' rarity in view of their conservation needs, it is imperative to have the ecological information in terms of their population status, habitat preferences and distribution pattern. During this session the audience received information about sustainability and Fairwild collection programmes in the World, supported by Traffic international. Many of ISBMAP participants believed that large scale collection in case of increasing target markets is not the way of supply of raw materials both from the quality or conservational aspects.

Within session Conventional Breeding, where utilization of natural variability (or generation of new variability) is an indispensable prerequisite for successful work, we received very useful information and practical examples on the importance of the flower biology and population structure for pollination and fertilization patterns (keynote lecture given by Dr. W.D. Blüthner, Germany). In the second keynote lecture Dr. Pank (Germany) showed us plant breeding fundamentals and 5 examples of successful breeding (Selection and inbreeding of *Origanum majorana* for maximising the essential oil content and for homogeneity of population; Combination of small fruits and high essential oil content by crossing of bitter fennel (*Foeniculum vulgare* Mill. ssp. *vulgare* var. *vul-*

Keynote speaker Dr. Friedrich Pank (Section: Conventional Breeding).

Participants at Bohinj Lake in Triglav National Park.

gare); Thyme (*Thymus vulgaris* L.) for breeding varieties with high performance and homogeneity with regards to yield, quality, winter hardiness, flowering period; Breeding the annual form of caraway (*Carum carvi* L. var. *annuum* hort.) for improved yield and essential oil content; *Hypericum perforatum* for the selection of wilt resistance (caused by *Colletotrichum* cf. *gloeosporioides*) strains).

Within session Biotechnology keynote speaker Prof. Dr. Oliver Kayser (The Netherlands) gave an overview on metabolic engineering and molecular biology strategies, which could be considered as new tools in MAP breeding and in production of natural compounds.

In session Methods for Economising Breeding Procedures Dr. Hartwig Schulz, Germany, gave an overview on analytical equipment and methods for quantitative analysis of chemical compounds in breeding research. Also, the relative new technique of protoplast fusion as a potential tool in plant breeding has been presented. Phytochemical characterization, together with molecular and morphological evaluation could be seen as a final step of an efficient breeding programme.

During the "Three great men" session 3 honour medals have been granted to Prof. Dr. Eli Putievsky (Israel), Prof. Dr. Chlodwig Franz (Austria) and Dr. Friedrich Pank (Germany), for their valuable work in the MAPs area.

The evenings' social programme enabled gathering of participants in a more relaxed atmosphere.

On Sunday, the 21st of June an excursion to Triglav national park was organized. During the excursion participants became aware of some Slovene Alpine particularities.

The manuscripts of presented oral and/or poster presentations will be published as a separate volume of *Acta Horticulturae*.

Dea Baricevic

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Section Nuts and Mediterranean Climate Fruits

Second Int'l Symposium on Pomegranate and Minor including Mediterranean Fruits

The II International Symposium on Pomegranate and Minor including Mediterranean Fruits – 2009, was held from 23-27 June 2009 at the University of Agricultural Sciences (UAS), Dharwad, Karnataka, India in collaboration with the International Society of Horticultural Science, State Department of Horticulture (NHM), Indian Council of Agricultural Research, National Horticulture Board, Agricultural and Processed Food Products Export Development Authority (APEDA), Karnataka State Agricultural Produce Processing and Export Corporation Limited (KAPPEC) and the Maharashtra Pomegranate Growers and Research Association. Several side events were also held during the symposium such as an exhibition, cultural programmes and field visits.

The symposium was attended by more than 100 participants from ten countries. Speakers from Turkey, Israel, USA, Australia and South Africa were invited to share their experience during the symposium. A total of 33 papers were presented orally, 76 papers were presented as posters. The symposium covered eight topics viz., National and International Scenario, Biotechnology and Propagation, Genetic Resource Management and Crop Improvement, Production Technology, Post Harvest Technology, Bacterial Blight of Pomegranate and Other Diseases, Integrated Pest Management, Economics, Trade and Extension followed by an exclusive session for farmers interaction.

Opening ceremony.

Lamp lighting by Mr. Umesh Katti, Honorable Minister for Horticulture, Government of Karnataka.

The inaugural function included an address by Dr. G. Finetto, ISHS representative, Mr. Umesh Katti, Minister for Horticulture, Government of Karnataka and Dr. J.H. Kulkarni, Convener & Vice-Chancellor, UAS, Dharwad. Dr. G.A. Finetto (Italy) elaborated on the activities of ISHS and presented a lead paper on 'Pomegranate industry in Afghanistan – Opportunities and constraints' in the first session on National and International Scenario. A very attractive cultural programme was arranged in the evening, highlighting Indian art and culture.

The second day started with the session on Biotechnology and Propagation. Dr. Ramanjini Gowda in his lead paper explained the major techniques used to improve these crops including plant tissue culture, use of molecular markers and genetic transformation. Genes coding for chitinases, glucanases, antimicrobial peptides, defensins, etc. can be engineered to control bacterial diseases. Similarly coat protein mediated RNAi and insect vector suppressor-mediated methods can be used to manage viral diseases. There were three more oral presentations.

In the third session on Genetic Resource Management and Crop Improvement, there were two lead lectures and four oral presentations. Dr. C. Yilmaz from Turkey presented his work on germplasm screening over a period of 3 years for different traits and the pomegranate cultivars 'Izmir 1264', 'Izmir 1223', 'Izmir 1226' and 'Izmir 1513' were found to be the best for several pomological traits. But some of them had hard seeds, 'Izmir 1513' was also found to be resistant to frost and several diseases. Dr. S.H. Jalikop presented a paper that gave a detailed account on the worldwide germplasm collections, sources of resistance to diseases, breeding objectives and breeding approaches to be followed both in pomegranate and annonaceous fruits He reported that 'Daru', a wild type, is resistant to bacterial blight of pomegranate but has several undesirable traits like very small fruit, hard seed, thick rind and sour taste.

The fourth session was on Production Technology, in which there were eight lectures including two lead papers. Dr. Erik D. Wilkins, Paramount Farming Company, California, highlighted in particular the use of single cordon system of training in pomegranate. Dr. Y.N. Reddy presented a lead paper on 'Certain new approaches to the production problems of pomegranate'. Use of tryptophan – 5 ppm in combination with *Pseudomonas fluorescens* at 5 g/L was found effective for the proliferation of the root system and the establishment of pomegranate orchard through cuttings. Representatives from M/s NETAFIM, Israel, M/s Akshay Food Park Ltd., Hiriyur, Karnataka (India) and M/s Pomeg Technique Ltd., Israel interacted with the audience through their company presentations.

The session on Post Harvest Technology included one lead lecture and three oral presentations covering major topics like cold storage, value addition, machinery for aril and juice extraction, quality of fruits for processing and export.

The third day of the symposium began with a session on Bacterial Blight of Pomegranate and Other Diseases. Dr. V.T. Jadhav, Director, National Research Centre for pomegranate, in his lead paper on 'Integrated management of diseases in pomegranate', highlighted that severity of the bacterial blight on pomegranate was more than 80% in many places during *mrig bahar* season. He also gave the explanation of wilt and other diseases and their management. Dr. V.I. Benagi, in his lead paper on 'Present status of pomegranate bacterial blight and its management' explained the detailed historical development of bacterial blight of pomegranate in India comprising Maharastra and Karnataka. There were four more oral presentations out of which two were exclusively on bacterial blight and the other two on the rest of the diseases of pomegranate.

Following this, a session on Integrated Pest Management was held with four oral presentations. Dr. H. Zolfagharieh from Iran presented the work on sterile insect technique for the management of Carob moth, *Ectomyelois ceratoniae*, on pomegranate. Dr. S.B. Jagginavar from Karnataka (India) presented a paper on Coleopteran insect pests of pomegranate and their management.

In the session on Economics, Trade and Extension, Dr. Dan Rymon from Israel presented a lead paper on 'Mapping features of the global pomegranate market', wherein he presented the global distribution of the sources of supply with respect to pomegranate products. He described the features of a large pomegranate market in Western and Central Europe.

Finally there was a session of farmers interaction wherein certain recommendations were made by the pomegranate growers viz., to develop registration of pomegranate nursery, to study on the enhancement of shelf life of arils, to develop soft seeded varieties of export quality,

Dr. G.A. Finetto presenting the ISHS medal to Honorable Vice Chancellor Dr. J.H. Kulkarni.

to take up legislative measures by government to encourage *hasta bahar* crop and to avoid *mrig bahar.*

The plenary session was chaired by Dr. H.P. Singh, DDG (Hort.), ICAR, New Delhi. He expressed that more integrated research and development efforts are needed to promote the products of pomegranate and other minor fruits in India and abroad as well. A total of 76 posters were presented on a variety of aspects of all above sessions. During the symposium there was also an attractive exhibition in which international firms dealing with irrigation and post-harvest aspects of pomegranate participated.

After hectic in-house deliberations for three days, a post-symposium tour to popular pomegranate growing belts for export comprising Bagalkot and Kaladagi area was arranged on the fourth day to keep abreast of the practices followed by the pomegranate growers. Further, the delegates also visited the historical monument *'Golgumbaz'* in Bijapur.

In general, the symposium was a big success getting appreciation by everyone for the arrangements. It was indeed a good opportunity for participants to enrich their knowledge and get the chance to interact with great personalities of the scientific community and decision makers spread across the globe, working on pomegranate and minor fruits.

A.N. Mokashi and M.K. Sheikh

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Fifth Int'l Symposium on Pistachios and Almonds

Delegates of the Symposium.

The 5th International Symposium on Pistachios and Almonds under the auspices of the International Society for Horticultural Science (ISHS) was very successfully held in Sanliurfa, Turkey from 6 to 10 October 2009. About 200 participants from Algeria, Australia, Bulgaria, Croatia, Greece, Iraq, Iran, Israel, Italy, Morocco, Portugal, Serbia, Spain, Tunisia, and Turkey attended the event. The symposium was organized by the University of Harran, Faculty of Agriculture, Department of Horticulture. It was supported by University Directories, Governor of Sanliurfa and other Government Companies such as Mayor of Sanliurfa, GAP Research and Development Administration, GAP Soil Water Resources, Agricultural Research Institute, Gaziantep Pistachio Research Institute, Sanliurfa Regional Directorate of Agrarian Reform, Gaziantep Trade and Industry Chamber, Sanliurfa Trade and Industry Chamber, Agriculture Chamber, Regional Directorate State Hydraulic Works (D.S.I.), Sanliurfa Trade Exchange, and other supporters from private sectors.

Dr. Damiano Avanzato (right) handing out the ISHS medal award to Convener Prof. Dr. Bekir Erol Ak (left).

The opening ceremony started with a welcome lecture by Prof. Dr. Bekir Erol Ak, Convener of the Symposium and head of the Department of Horticulture, in which he extended his thanks and gratitude to the distinguished participants, particularly those from other countries, and also very cordially thanked the members of the Scientific and Organizing Committees and his colleagues of the Faculty of Agriculture and Gaziantep Pistachio Research Institute. He continued his speech with thanking the Directorate of ISHS, the Rector of the University of Harran for his encouragement and support to organize this meeting and the Dean of the Faculty of Agriculture. His special thanks went to Dr. Damiano Avanzato, Chair of the ISHS Section Nuts and Mediterranean Climate Fruits, CIHEAM-IAMZ Zaragosa, FAO-CIHEAM Nut Network and Gaziantep Pistachio Research Institute, and others for their support. The Convener underlined the importance of this ISHS Symposium as a useful way to exchange scientific knowledge in relevant fields and genetic material in the different contributor countries, and to start a good collaboration with pistachio and almond industries. During his lecture, the Convener mentioned the important role of the Southeast Anatolia Region for the Turkish agriculture, and particularly for fruit culture. The Southeast Anatolia Region, where Sanliurfa is located, is one of the major areas traditionally affected by local drought conditions, where pistachio is grown intensively. Therefore, for many years - before "Atatürk Dam" establishment - pistachio and almond orchards were developed under drought conditions as crops able to exploit such restrictive pedoclimatic conditions. However, at the moment pistachio and other agricultural crops are grown with irrigation facilities and, as consequence of that, the growers obtain high amount of yield and quality of crops.

The second presentation was delivered by Prof. Dr. Mehmet Ali Cullu, Dean of the Faculty of Agriculture, who gave his warmest welcome to the esteemed scientists participating in this symposium.

The third presentation was made by Dr. Damiano Avanzato, ISHS representative. At first he warmly welcomed all distinguished guests and expressed his deep appreciation and thanks to all organizers of this symposium. He underlined that this could be a good opportunity for exchanging the latest research highlights, meeting other researchers and getting more acquainted with advances and new technologies. He also gave information about ISHS activities and invited all participants to join the ISHS for strengthening this international society. At

Convener (right) and Rector of the University (center) presenting a plaquette to Prof. Dr. Nurettin Kaska (left).

Discussion in front of almond seedling.

Visit to a processing plant of pistachio.

the end of his presentation he handed out the ISHS medal to Prof. Dr. Bekir Erol Ak and he also awarded a medal to Prof. Dr. Nurettin Kaska for his long ISHS membership and for his researches on pistachios and almonds.

The fourth presentation was made by Prof. Dr. Ibrahim Halil Mutlu, Rector of the University, who gave some information about the University and Sanliurfa and mentioned that University facilities are always available for collaboration with other countries.

After the welcoming ceremony, Dr. Avanzato gave a lecture on "Traditional Knowledge on Pistachio and Almond", after which the scientific sessions started. The programme was scheduled as follows:

a) three days (Tuesday, Wednesday and Friday) were devoted to scientific sessions with presentations and discussions of papers and posters
b) two days (Thursday and Saturday) were devoted to technical excursions and a cultural trip to the historical place of Harran ruins.

SCIENTIFIC PROGRAMME

In terms of scientific contributions, 113 oral and 133 poster presentations were discussed, of which 132 concerning pistachio and 114 almond. The papers were presented in the following sessions: Pollination and fruit set (24 papers), Physiology and nutrition (62), Propagation and rootstocks (16), Cultivars and breeding (46), Biotechnology (42), Orchard management (12), Plant protection (33), Harvesting and processing (10), and Economics and marketing (19). Among topics discussed, germplasm characterization and assessment, development of new varieties and pollinators and rootstocks through hybridization aim to improve the expansion of these crops, their productivity and their environmental adaptation. The effect of conservation and processing techniques on quality has also been emphasized. Moreover, greater interest was shown in the post-harvest stage effect, especially in aflatoxin contamination, to ensure healthy and good quality product. At the local and international level, pistachios and almonds market surveys are conducted to win market share through the improvement of quantity and quality of products, the development of new post-harvest treatment systems, the processing and packaging and the adoption of effective marketing strategies.

TECHNICAL PROGRAMME

A technical tour was scheduled to the fruit tree orchards in the University of Harran. Next to this, participants had the chance to visit Ceylanpinar State Farm, a private production and processing farm, where the experimental orchards of pistachio and almond gave an overview of the research programmes underway and some results obtained. In the experimental orchard, different studies were conducted on the effect of rootstocks on growth and productivity of pistachio, the scion/rootstock compatibility, the assessment of main Turkish varieties in comparison with foreign varieties and the effect of irrigation on production. All the steps of pistachio (cv. Siirt) mechanical dehulling were observed in a private post-harvest processing manufacture. On the last day of the Symposium, the participants travelled to Gaziantep, the main pistachio growing area. The visit of several pistachio orchards showed the orchard management adopted, the advanced age of some plantations, the scion/rootstock incompatibility of few rootstocks and some sanitary problems such as aphids and *Septoria* on *Pistacia vera* leaves. Finally, the trip ended with a visit to the Pistachio Research Institute of Gaziantep. The current research activities in the laboratories of physiology, soil analysis and plant protection were presented. During the tour in the experimental orchards of this institution, the participants visited the nurseries producing grafted seedlings of pistachio and almond, the assessment plots of male and female varieties and progenies issued from hybridization. An overview of few varieties and pollinators features obtained by hybridization was presented.

At the end of the Friday afternoon session, the closing ceremony was held. The Convener, Prof. Dr. Bekir Erol Ak, thanked the participants and made a short analysis of the scientific achievement of the Symposium. Then the ISHS representative, Dr. Avanzato, invited the assembly to vote for the next country organizer of the 6th Symposium. The Assembly voted between the three proposals, formulated by Italy, Spain and Morocco, and Spain was elected as the host for the next Symposium.

Bekir Erol Ak

The plaquette ceremony for supporters and organizers.

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Int'l Symposium on Olive Irrigation and Oil Quality

Participants of the Symposium at the summit of The Mount of Precipice, Nazareth.

Olive (*Olea europaea* L.) is one of the oldest and most traditional fruit tree commodities originating and still highly exploited in and around the Mediterranean basin. During the last 50 years the demand for the main product of the olive, its oil, tripled. As a result, new approaches to enhance production, mechanize cultivation and modernize oil extraction were employed. The most profound change of the olive industry from a traditional extensive industry to a modern economical developing one was due to the introduction of irrigation and intensification of cultivation. In spite of the rapid development of orchards using irrigation and intensification methodologies the expertise for optimization of their potential is still in the initial stage. The symposium on olive irrigation, nutrition and oil quality was the first devoted entirely to this subject in relation to the olive commodity. Top researchers in the field met in order to exchange ideas and share the latest research results achieved specifically for the olive industry. The symposium was divided into seven sessions illuminating different aspects of the effects and methodologies of water and nutrient application to the olive trees. Studies showing different approaches to control and monitor water requirements and to minimize water losses during irrigation were discussed. As water is both expensive and scarce in most olive growing regions, both traditional and newly developed, the potential use of deficit irrigation and water saving technologies were the subject of various studies. Emphasis was put on understanding the unique physiological aspects of hydraulic conductance of water and the specific stomata activity in leaves of the olive trees. The importance of water stress periods on inflorescence and flower development was the subject of a study in relation to deficit irrigation. Another important aspect widely investigated and reported was the use of brackish and recycled water in olive cultivation. The olive, which is rather tolerant to salinity, was shown to produce quality oil also under controlled irrigation with 'low' quality water. In a special session the interaction between the efficiency of water application and plant nutrient requirements was elaborated. It was shown that in order to reach optimal effects of water application on olive performance an interaction with an adequate nutrient requirement is most critical. The studies reported dealt both with tree growth and fruiting potential as well as with the effect of the levels of various elements, particularly nitrogen, on oil composition. In all studies the effect of olive irrigation and intensification on oil characteristics composition and quality was considered. Mainly changes in the accumulation of polyphenols, unsaturated fatty acids and levels of free acidity were indicated, particularly in unbalanced irrigation. The effect of water application to the olive tree on oil characteristics and extraction efficiency was also discussed in a special session devoted to specific adaptation required in the oil mill technology for irrigated olives. During three field excursions various aspects of irrigation methodology, technology and equipment used in Israel were demonstrated. The response of different cultivars to intensification - fertigation and harvest mechanization - were both discussed and visualized during the field visits. During the post symposium tour ongoing research on irrigation and nutrition under controlled conditions at the Gilat Center of the national Agricultural Research Organization was demonstrated. The tour included also a visit to commercial highly intensive olive orchards irrigated with brackish water in a desert environment.

Professional visit to the lysimeters experimental site at Gilat Research Center in the northern Negev desert.

The International Symposium on Olive Irrigation and Oil Quality was held during 6-12 December 2009 in Nazareth, Israel. About 150 scientists, experts, extension specialists, orchard managers and students took part in the symposium including 80 international participants from 16 different countries. Forty invited and contributed oral presentations were delivered and 32 posters displayed and discussed. The Symposium was organized under the hospitality of the Israeli Agricultural Research Organization (ARO) and the Hebrew University of Jerusalem (HUJ). The Symposium was sponsored by the Israeli olive council, various Israeli companies involved in the olive industry and the international bodies ISHS, IOC, and USDA.

Dr. Facundo Vita (in the middle) handing out the ISHS Medal Awards to the Symposium Conveners, Prof. Shimon Lavee (right) and Dr. Uri Yermiyahu (left), during the farewell dinner, Jerusalem.

Shimon Lavee and Uri Yermiyahu

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Eleventh Int'l Symposium on Plant Bioregulators in Fruit Production

Participants of the Symposium.

The 11th International Symposium on Plant Bioregulators in Fruit Production held in Bologna, Italy on September 20-25 was organized by the Department of Fruit Tree and Woody Plant Science of the Faculty of Agriculture of the Alma Mater Studiorum, University of Bologna under the auspices of the ISHS Working Group on Bioregulators in Fruit Production of the Section Pome and Stone Fruits. It is the 11th in the series of international symposia dedicated to understanding the role, the importance and the mode of action of Plant Bioregulators in Fruit Production.

Prof. Guglielmo Costa, Symposium Convener and Chair of the ISHS Working Group on Bioregulators in Fruit Production.

At the opening ceremony Prof. Guglielmo Costa, Convener of the Symposium and President of the ISHS Working Group, welcomed the 200 participants from more than 40 countries and illustrated the Symposium structure: the first 4 days (20-24 September) were dedicated to the presentation of the keynote and oral communications (more than 50) and the poster session (more than 100 posters). Tuesday afternoon a technical visit to Ferrara area offered the possibility to the participants to visit the most important nursery facilities, apple and pear modern orchard and the Pomposa Abbey (700 AC).

Table 1. Scientific programme of the Symposium.

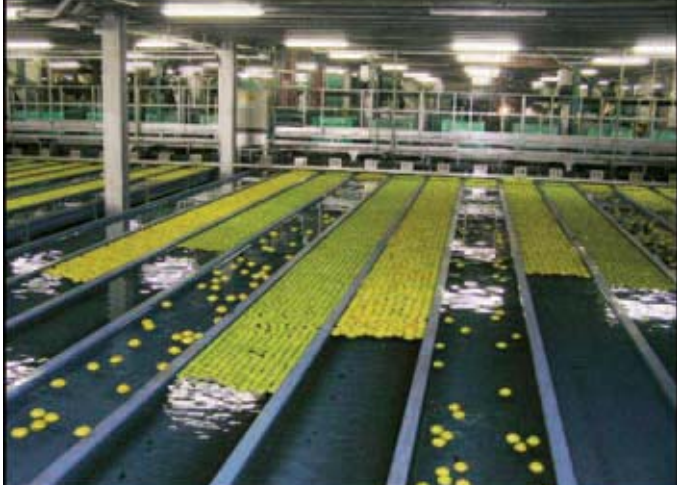
The main topics
1. Biological Aspects of Plant Bioregulators
a) Biosynthesis
b) Physiological and molecular mode of action
c) Interactions among bioregulators
2. Fruit Trees Developmental Processes
a) Propagation
b) Vegetative growth
c) Dormancy
d) Flowering and fruit set
e) Fruit abscission and crop load control
f) Ripening and fruit quality
3. Technical, Environmental and Social Aspects of Plant Bioregulators
a) Naturally occurring plant bioregulators
b) Novel synthetic plant bioregulators

The scientific program of the Symposium was organized in 3 main sessions, the first on Biological Aspects of Plant Bioregulators, the second on Fruit Trees Developmental Processes and the third on Technical, Environmental and Social Aspects of Plant Bioregulators (Table 1).

The first opening lecture was delivered by Prof. Duane Greene of the University of Massachusetts, who presented the state-of-the-art reached by the bioregulators' application considering some case studies (fruit thinning, etc.). The second speaker, Prof. James Giovannoni of Boyce Thompson Institute of Ithaca, New York State, defined what the molecular biology knowledge could mean for the understanding of the role of hormones and the control of some processes (i.e. fruit ripening).

The last two days were dedicated to the post-symposium tour that led the participants to the Melinda consortium at San Michele all'Adige research centre (IASMA) and to the Verona area in northern Italy. The participants had the chance to visit the apple and grapevine breeding programme carried out at IASMA, apple, pear and kiwifruit orchards, and a cantina specialized in very high quality Valpolicella and Amarone wine. The participants also could visit the city of Verona (Juliette's house, etc.).

The general objective of the Symposium was to strengthen the collaboration among physiologists, molecular biologists and pomologists. The



The Melinda Consortium (Val di Non, Italy).

The apple breeding experimental orchard hosting the apple selections at IASMA (Istituto San Michele all'Adige, Trento).

purpose was to increase the understanding of the physiological and molecular mode of action of plant bioregulators to improve the application strategy to affect and control the main fruit tree developmental processes. All this should lead to combining environmental and food safety priorities with the need to maintain high quality and quantity level of the fruit production.

It was clearly stated during the Symposium that new generation PBRs are few, although there are some molecules naturally present in fruit trees that show interesting application (jasmonic acid, salicylic acid, polyamines, etc.) as well as ABA that might represent in the near future a very interesting PBR to act against diseases, to increase fruit appearance and quality and even to allow water saving.

A French research group (C. Rameau) presented the results obtained on a new molecule, strigolactone, a "carotenoid derived compound", which can be considered a new hormone able to affect the vegetative habit of a plant.

The Symposium ended with a round table discussion where G. Costa, Symposium Convener and Chair of the ISHS Working Group on Bioregulators in Fruit Production, D. Greene, past Chair, T. Webster, Chair of the ISHS Section Pome and Stone Fruits, M. Fidelibus, Plant Growth Regulators Society of America (PGRSA) President, J. Cohen, International Plant Growth Substance Association (IPGSA) President, and two chemical company representatives, W. Rademacher of BASF and J. Hansen of Valent Bio Sciences (VBS), all acted as opinion leaders answering the questions on the floor and stimulating the discussion of the following topics:

- How will PBR use evolve and how can we best anticipate the changes to maximize their effectiveness?
- Is it in our collective best interest to have a mutual symposium? What are the synergies that would occur as a result of joint meetings?
- What is the best way to foster mutual research with emerging economy countries?
- What PBRs will be available, where will they come from and when can we expect them to arrive?

It has been agreed that it will be extremely complicated, in most cases impossible, to grow fruit trees without PBRs: root formation, branching, shoot growth control, fruit set and fruit thinning, fruit quality enhancement, ripening control, etc. are processes where the PBRs play a very important role.

Participants and accompanying persons were entertained during the Symposium featuring a wide variety of Italian food and wine and Italian entertainment including music and dance.

Although the place has not yet been defined clearly the next Symposium will be held in four years time in North America. Prof. Guglielmo Costa was confirmed as Working Group Chair for the next four years.

The Proceedings of the Symposium will be published as a volume of *Acta Horticulturae*.

Guglielmo Costa

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Section Vegetables

Fifth Int'l Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops (SEST 2009)

The V International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops, 'Integrating Methods for Producing More with Less', was celebrated in Murcia-Almería, Spain, 27th September-1st October 2009. It was organised by the CEBAS-CSIC and Fundación Cajamar, in collaboration with the Polytechnical University of Cartagena (UPCT), the Instituto Murciano de Investigación y Desarrollo Agrario (IMIDA) and the Spanish Society for Horticultural Science (SECH). For the first time, and responding to the slogan of the symposium, it was done under the aegis of the International Societies for Horticultural (ISHS) and Seed (ISSS) Sciences. More than 110 delegates from 25 countries attended the conference, yielding a technical program with 34 oral and 50 poster presentations, 14 of which were keynote invited speakers. In addition, industry representatives from Bioibérica, OpenNatur, Walz and LemnaTec presented their best products with applications pertinent to the symposium.

The symposium was organised in 9 sessions covering the following areas: Seed Genetics and Biotechnology, Seed Germination and Vigour, Germplasm Protection, Nursery Greenhouse New Technologies, Seed and Transplant Production (including organic), Stand Establishment and Field Performance, Abiotic/Biotic Stress on Seedlings and Transplants, Grafting and Stand Establishment, and Integrating Technologies. The program included two technical visits, one of them organised by Fundación

Participants of the Symposium. Photo by courtesy of Silvana Nicola

Cajamar to visit the outstanding greenhouse technologies developed at la Estación Experimental Las Palmerillas, and the research centre of one of the most important Spanish seed companies, Ramiro Arnedo S.A., both in Almería area. Another technical visit was performed to Semilleros El Mirador S.A., an important self-made seedling company, where the most modern systems for both traditional and organic transplant production of several species like pepper, celery, onion and lettuce were displayed. This company, like the symposium venue, is located in one of the most important horticultural areas worldwide, Campo de Cartagena, producing more than 3,700 million transplants per year, with an economic value of about 100 million Euros.

Crop performance depends not only on the growth conditions in the field but also and essentially on the optimisation of several previous steps during seed germination, transplant production and stand establishment. Each one of these processes requires basic understanding at the molecular and physiological levels to develop genetic and agronomical applied strategies leading to crop improvement under the changing and often suboptimal environmental conditions. Additionally, the increasing human population and the scarcity of natural resources make necessary efforts to integrate a wide array of methods on different research areas in order to produce more with less.

Technical visit to Las Palmerillas Experimental Station. Outstanding greenhouse technologies and crop management in Almería.

In the opening remarks, the ISHS representatives – Drs. Daniel Leskovar, Texas A&M University, and Silvana Nicola, University of Torino - and the ISSS representative – Dr. Bill Finch-Savage, HRI-Warwick - welcomed the symposium participants and outlined the scopes of both societies in international meetings as well as the interest and opportunity of maintaining the joined collaboration in the future. A full day was devoted to the specific Seed Biology sessions. Drs. Juan Jordano (IRNASE-CSIC, Sevilla, Spain) and Hiro Nonogaki (Oregon University, USA) showed the newest advances in the regulation of genetic programs during embryogenesis and germination and their potential biotechnological applications for dramatically improving seedling desiccation tolerance, vigour and stand establishment under unfavourable conditions. Dr. Kent Bradford (University of California, Davis, USA) presented recent insights on the genetic variability and hormonal regulation by ABA, ethylene and gibberellins, to improve seed germination at high temperatures in lettuce. Dr. Bill Finch-Savage (HRI, UK) showed the progress made with a simulation model to predict seed germination vigour by using *Brassica* and *Arabidopsis* as models, and its application to identify useful genetic (QTLs) and physiological markers to improve this important agronomical trait.

SEST 2009 Conveners Drs. Pascual (top right) and Pérez-Alfocea (center) and ISHS representatives Drs. Silvana Nicola (bottom right) and Daniel Leskovar (left). Photo by courtesy of Silvana Nicola

In the Germplasm Protection session, Dr. Jaime Prohens (Polytechnical University of Valencia, Spain) talked about the application of genetic markers (AFLP and SSR) as a useful tool to protect traditional germplasm as is the case for Spanish local eggplant varieties. Drs. Toyoda and Matsuda (Kinki University, Japan) used amazing animated presentations to introduce prototypes of new electric devices developed to control different pests (e.g. fungus pathogens and whiteflies) in greenhouses. Dr. Daniel

Technical visit to a lettuce field at transplant in the post-symposium tour.

Cantliffe (University of Florida, USA) was the keynote speaker of the Stand Establishment and Field Performance session and discussed new and popular stand technologies available to mitigate field stress such as adequate planting schemes, seed priming, coating technologies and containerized transplants. Dr. Silvana Nicola (University of Torino, Italy) presented an overview on the major problems the development of organic transplant production in Europe is undergoing as well as the major urgent goals that should be addressed for a proper development of this growing economic activity.

Drs. Daniel Leskovar (Texas A&M University, USA) and Ian Dodd (Lancaster University, UK) presented different techniques to control drought stress in transplants by manipulating hormonal relations, such as the application of ABA to reduce transpiration and to control vegetative growth, or soil inoculation with some specific rhizobacteria that degrade the ethylene precursor molecule ACC and thus reducing its negative impact on shoot growth and leaf senescence, with reported yield improvements by 20% under limited water supply. The session on Grafting and Stand Establishment registered one of the highest numbers of contributions, and, as proposed by Dr. Chieri Kubota (University of Arizona, USA), the time scheduled for this session must be significantly increased in the forthcoming meetings. In this session, the keynote speaker Dr. Beny Aloni (Volcani Center, Israel) addressed the auxin-ethylene interactions as a mechanism to explain grafting incompatibility in melon/*Cucurbita*. Dr. Francisco Camacho (University of Almería, Spain) presented the use of grafting in melon as alternative to chemical disinfection to control some diseases in Mexico. In the last session on Integrating Approaches Dr. Gerhard Leubner (University of Freiburg, Germany) presented the 'Virtual Seed Project' as a model of integration of different disciplines (from molecular genetics to bioinformatics) to control seed germination. Similarly, Dr. Fred van Eeuwijk (University of Wageningen, The Netherlands), also presented the 'Spicy' project as a smart integrative model for prediction and improvement of crop yield.

Finally, at the business meeting, Korea and Brazil presented candidatures for the organization of the next SEST symposium, and Dr. Warley do Nascimento (Embrapa, Brazil) accepted the task to host it in 2012.

José A. Pascual and Francisco Pérez-Alfocea

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Commission Quality and Post Harvest Horticulture

First Int'l Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions

Postharvest technology is an area where basic principles can be applied to a great range of horticultural perishable commodities. However, specificity is needed in many cases. What is used for temperate fruits cannot necessarily be applied for tropical fruits. Quality issues observed in temperate zones with vegetables grown in open fields are not necessarily the same issues prevalent in similar vegetables grown in the tropics. Moreover, research that is developed in many tropical countries is often not disseminated beyond country frontiers, resulting in unnecessary delays for technology development. At the 2006 International Horticultural Congress in Seoul, Korea, the Commission Quality and Post Harvest Horticulture, chaired by Dr. Pietro Tonutti, considered ways to stimulate the exchange of information that is generated in the tropics. For this, it was thought key to organize a conference at a strategic tropical location allowing the presentation of works in both English and in the language of the host country.

The First International Conference on Postharvest and Quality Management of Horticultural Products of Interest for Tropical Regions took place in San José, Costa Rica during July 20 to 23, 2009. This was the first ISHS meeting held in Central America and one of very few that has showcased bilingual conferences (Spanish and English in this case). The themes that were addressed during this conference included: The role of pre and post-harvest technology in quality, nutritional value, and food safety of tropical horticultural crops; Postharvest management and quality of non-traditional tropical fruits; Food safety and nutritional quality of whole and pre-cut products; Advances in postharvest operations; Outreach and farm-to-table systems, country issues: new trends and constraints; Genomics, senescence reduction and alternative treatments; Postharvest diseases and microbial spoilage; Trade and postharvest issues of ornamentals and cut flowers.

Attendees at the conference closing dinner.

The attendance was about 130 participants from 20 countries of which about 1/3 represented the private sector. The conference featured 14 invited speakers from 8 different countries. As an interesting fact one of the presentations was given by Dr. Lise Korsten directly from South Africa since she could not make the trip to Costa Rica at the last minute. The presentation became a highlight given the clear internet communication, permitting interaction with participants, and the outstanding technical content.

Due to the large number of participants from the industry the organization decided to set up an open roundtable to discuss emerging postharvest issues in the pineapple industry. The active discussion involved several people from industry and academia. Topics such as induction of external color for organic pineapple, residues of ethephon in fruits reaching the European Union, coatings for organic pineapples and fluctuating prices in certain markets were among those that were brought to discussion.

The conference started with two days dedicated to presentations, combining contributors and invited speakers. On the third day attendees had the option of joining one of three technical tours that were offered. One tour involved visiting an operation of tropical foliage and ornamentals in the Caribbean coast of Costa Rica. Another option was a tour to visit a chayote (*Sechium edule*) packing house that ships product to the international market. The third tour was hosted by the Agroindustrial Development Program (PROAGROIN), an operation of organic pineapple companies that groups hundreds of small growers in the northern region of San Carlos. About 80 people in total participated in the technical tours.

Pietro Tonnutti (left) conferring a medal to Felipe Arauz (right), Convener of the Conference.

Audience listening to the manager of PROAGROIN, an organic pineapple packing house.

An executive meeting scheduled by the end of the conference provided a forum to discuss the value of continuing with a series of conferences on Postharvest and Quality Management in the Tropics. Everyone was in favor of continuing as this was an excellent opportunity for networking among researchers that not commonly meet in international events. The group voted unanimously for Prof. Soledad Hernández, from the Instituto Amazónico de Investigaciones Científicas - SINCHI as the new convener of the 2nd meeting in this series. This event will be held in Bogotá, Colombia during 2011, with the support of the newly appointed Chair of the Working Group on Postharvest in Emerging Countries, Dr. Jorge Fonseca.

We want to deeply thank the local Organizing Committee for their outstanding effort, which was fundamental to bring the event to successful completion.

Jorge M. Fonseca Laurent and
L. Felipe Arauz Cavallini

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Conference "Kunst - Garten - Kultur, Perspektiven gartenkultureller Forschung an der Universität der Künste Berlin" (Art - Garden - Culture, Perspectives of Garden Cultural Research at the Berlin University of the Arts)

The contributions to this conference at the Berlin University of the Arts oscillated between topics related to art and culture in connection to gardens. The Berlin University of the Arts aims at uniting all arts under one roof. So here the question was if there is any meaning for garden art in scholarly programs that tap both art and science. Are there any interdisciplinary perspectives for garden related topics? What are the chances for future institutional integration of garden art at the Berlin University of the Arts?

The retirement of Gert Groening from his position as Professor of garden culture and open space development at the Institute for History and Theory of Design at the Berlin University of the Arts gave reason to search for answers to such questions. Groening continues to serve as Chairman of the Commission Landscape and Urban Horticulture of ISHS. Since 1985 Groening has made garden culture and open space development into a very active and prolific field for garden cultural research. Instead of looking back upon almost a quarter century of successful scholarly work the "Art - Garden - Culture" conference, held on 3-5 July 2009, addressed possible futures for garden research.

Eighteen scholars from Germany and abroad presented their special garden cultural research perspectives. The disciplinary spectrum of this outstanding conference ranged from literature to design theory, and from classical art history to social science empirical studies. In four sections the presentations and discussions were focussed upon "Gardens and Science", "Gardens and Media", "Gardens and Politics" and "Gardens and Music".

GARDENS AND SCIENCE

In his presentation Stefan Schweizer, Junior Professor of garden art history at the art history seminar at Heinrich Heine University in Duesseldorf, Germany, outlined "The Development of Garden Art as Discipline within the System of Early Modern Arts". Uwe Schneider, who for several years collaborated with Gert Groening in basic research, mostly funded by the German Research Community (DFG), such as to increase the access to legacies of garden and landscape architects, to contributions to professional journals and to scholarly resources for garden art in libraries and archives, gave a talk about "The Access to Resource Material in Garden Cultural Research - An Inner-European Comparison". Sonja Duempelmann, who had Gert Groening as supervisor for her doctoral dissertation "Maria Teresa Parpagliolo-Shephard (1903-1974), Ein Beitrag zur Entwicklung der Gartenkultur in Italien im 20. Jahrhundert" ("A Contribution to the Development of Garden Culture in 20th Century Italy"), within the post-graduate program "Practice and Theory of Creative Processes in the Arts" at the Berlin University of the Arts, and who now serves as Professor of landscape architecture at the University of Maryland in College Park, USA, presented the first results of her most recent research in a contribution "The View from Above: Hidden and Discovered Landscape between 1920 and 1945", which was an unusual example of the connection between design teaching and scholarly research. Carolin Mees, now at the Technical University of Graz, Austria, whose doctoral dissertation is supervised by Gert Groening, allowed a glimpse into her research about "Community Gardens in New York City as Privately Used Public Gardens".

GARDENS AND MEDIA

"Gardening like Goethe - Design Rhetorics and Design Discourse Today" was the title of the talk from Annette Geiger, Professor of design theory at the College for Arts in Bremen, Germany, in which she showed, based upon an analysis of current styling-magazines, how gardening became again a way of bourgeois cultivation and societal distinction. In his contribu-

Conference participants and Prof. Martin Rennert, President of the Berlin University of the Arts, applauding Prof. Gert Groening. Photo by Clemens Menne.

Prof. Joachim Wolschke-Bulmahn addressing conference participants. Photo by Clemens Menne.

Stefanie Hennecke lecturing conference participants during Berlin-Mitte excursion. Photo by Gert Groening.

tion, Toni Bernhart, literary scholar, theater author and coordinator of the "Graduate School for the Arts and Sciences" at the Berlin University of the Arts, presented the "Remarkable Harmony of the Garden in Sophie Bernhardi's *Evremmont*" and pointed out the symbolic attributions to a literary garden in Bernhardi's novel.

In her presentation "*Mon Oncle* or the Cineastic Garden as City Planning Argument", Nina Gerlach, who writes her doctoral dissertation at the Center for European History and Culture Sciences at Ruprecht-Karls-University in Heidelberg, Germany, discussed how the perfect synthetic effects of this almost overdrawn caricature of a film garden reflect the comparably artificialized ways of life of its inhabitants. Jessica Ullrich from the Institute for Art Science and Aesthetics at the Berlin University of the Arts focussed upon "Artificial Gardens - Nature as Material and Medium for Current Art" and gave various examples of "artificial gardens" where artists processed nature as material, medium, motive or metaphor.

Joachim Wolschke-Bulmahn has collaborated for many years with Gert Groening. Supervised by Groening, Wolschke-Bulmahn had been the first to hand in a doctoral dissertation "The Search for Arcadia. About Landscape Ideals and Ways of Nature Appropriation in the Youth Movement and Their Meaning for Land Maintenance" at the architecture program of the Berlin University of the Arts in 1989. Since 1996 Wolschke-Bulmahn has served as Professor of history of open space planning at the Institute for Landscape Architecture at Leibniz University in Hannover, Germany. In his fest lecture "Garden and Landscape Architecture in Comics" on the occasion of Groening's retirement from the Berlin University of the Arts Wolschke-Bulmahn not only hinted at the amusing aspects of his topic for a scholar but also proved the research potential embedded in it and thus closed the section Gardens and Media.

GARDENS AND POLITICS

The "Reconstruction of the Yuheyuan as a Manifesto of Political Authority" is, as Bianca Maria Rinaldi, scholarly assistant at the Technical University of Graz, Austria, explained the two times reconstruction of this "Garden of the Preservation of Harmony" in Beijing, P. R. China, in 1888 and 1903, an especially remarkable example of symbolic meanings ascribed to a Chinese imperial garden.

Dorothee Brantz, Junior Professor and Director of the Center for Metropolitan Studies at the Technical University Berlin, Germany, outlined the destruction and reconstruction of the Berlin Tiergarten in her presentation "In the Shadow of War: The Berlin Tiergarten 1943-1948". Johanna Soehnigen, who works as research assistant with Gert Groening in a DFG-financed project about bourgeois garden culture around 1800, and Rainer Schmitz, presented in their contribution "Ur-Landscaping - The Design of the 1936 Olympic Village" an example of targeted political ideologisation of landscape architecture.

"Taking a Bath for the Economy. The Open-air Pool in the Woods Steinbachtalsperre of the 1930s in the Eifel Region" was the title under which Gundula Lang, a former fellow supervised by Gert Groening in the post graduate program "Practice and Theory of Creative Processes in the Arts" at the Berlin University of the Arts, who now serves in the Rheinland Monument Maintenance Authority in Pulheim near Koeln, Germany, presented another example of "landscape-bonded building" during National Socialism, even if it has not decidedly been conceived as NS-propaganda project. In addition to the presentations in the section "Gardens and Politics" Stefanie Hennecke, teaching and research assistant of Gert Groening in the field Garden Culture and Open Space Development of the Berlin University of the Arts, invited the conference attendants to participate in a walking excursion "New Design of Public Spaces in the Historical Center of Berlin" through the newly built quarters in Berlin-Mitte, where she pointed out the changing influence of a political guideline for city development upon the design of garden spaces.

GARDENS AND MUSIC

In his lecture "The Aeolian Harp. An Instrument for the Musicalisation of 18th and 19th Centuries Gardens", Martin Ullrich, President of the College for Music in Nuremberg, Germany,

Gert Groening and Stefanie Hennecke. Photo by Anastassia Bichan.

Gert Groening digging plants for his guerilla garden. Photo by Klaus Gröning.

sketched the development of sound landscapes via Aeolian harps in romantic gardens. Olivier Perrier, who had participated in a seminar "Garden - Dance - Landscape" by Gert Groening at the Berlin University of the Arts some years ago and who currently writes his doctoral dissertation at the Laboratoire d'Analyse des Formes in Lyons, France, gave an idea of the multilayered relations between dance as a music-based art form and garden art in his talk about "Ornamental Space Formulas in 17th Century French Dance and Garden Art".

Annette Richards, Professor of music history and organist, and David Yearsley, Professor of music history and performance practice, both at Cornell University in Ithaca, New York, USA, discussed in their presentation "Play spaces for Music between Concert Hall and Open Air" current plans for public open spaces in Los Angeles, California, as reflected in the Hollywood movie "The Soloist" by Joe Wright.

In all the very stimulating contributions to the four conference sections demonstrated how alive and varied current perspectives of garden cultural research are. All presentations excelled by refreshingly sharpened focuses of the topics. At the same time the contributions to the conference gave ample evidence of the multitude of questions for future research. A book edited by Gert Groening and Stefanie Hennecke that assembles the contributions to this conference will be published by Reimer Verlag in Berlin in May 2010.

Gert Groening and Stefanie Hennecke

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Tenth Asia-Pacific Bonsai and Suiseki Convention, Changhua Province, Taiwan

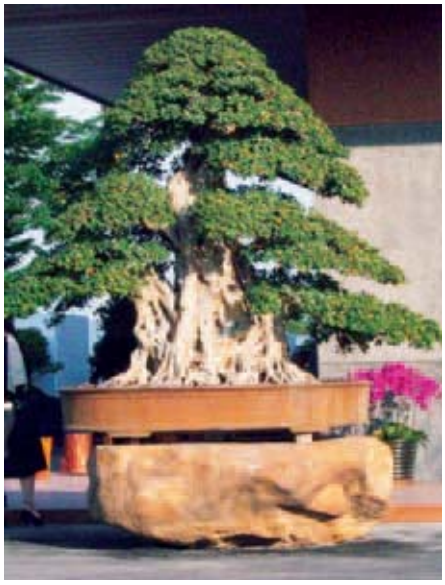
Bonsai at 10th ASPAC.

Organizers of the long-running Asia-Pacific Bonsai & Suiseki Convention and Exhibition (ASPAC) invited the ISHS to participate in their tenth anniversary exhibition in Taiwan, held from 31 October through 2 November, 2009. The Opening Ceremony was attended by 760 international participants, who were greeted by Taiwan's President Ma Ying-jeou and many local dignitaries. In the opening weekend of the exhibition, several thousand local Taiwanese thronged to the Wann Yiing Art Center and His Caou Garden to view about 560 bonsai trees and nearly 100 suiseki (natural and groomed artistic stones such as displayed in oriental gardens).

A dozen Master bonsai experts from as far away as Spain, Puerto Rico, Australia, India, Indonesia, Japan, and the USA as well as local experts from China and Taiwan showed how to shape and groom bonsai trees in different styles. Such manipulations were reminders of the parallels to fruit tree and landscape plant management practices in the crop production side of horticulture. It was a bit startling to observe some Masters chiseling away at branch stubs that would later be sanded to impart an ancient weathered look.

While such traditional plants as pines and junipers were well represented among the displays, a number of subtropical and somewhat hardy tropical species were displayed, including *Bougainvillea, Ficus microcarpa, F. benjamina, Hibiscus tileaceus, Premna obtusifolia, Podocarpus macrophyllus, Murraya paniculata, Casuarinia equisetifolia, Wrightia religosa, Malvaviscus arborescens,* and *Pemphis acidula*. While most of the displayed trees were sizable (up to 1.5 meters across by nearly a meter in height), miniature trees were also on display. The convention had no scientific or lecture-style program, letting the Masters and the trees speak for themselves.

Big bonsai.



Dr. Richard Criley (left) and Mr. Chen Tsang Shinh, President of 10th ASPAC (right).

Participants were treated to displays of local culture during the noon and evening meals, including musicians, acrobats, dancers, and actors representing indigenous cultural figures. Changhua county is well known for its production of cut flowers and ornamental plants, and numerous flower arrangements attested to the bounty of beauty. A side tour for participants took them to TanYei, a narrow street of garden centers and horticultural supply retailers where they eagerly sought high quality bonsai containers.

It was also my pleasure to be able to visit the Taichung district Agricultural Research and Extension Station in TatSuen to see laboratories, field and greenhouse plots supporting an array of horticultural and agronomic crops. In addition, I met with Dr. Yung I. Lee, Convener of the First International Orchid Symposium, and found that he had the January 2010 program well in hand, and an excellent site at the National Museum of Natural Science in Taichung was well-equipped to host the conference.

Takamatsu, Japan, will host the 11th ASPAC Bonsai & Suiseki Convention and Exhibition in 2011.

Richard A. Criley
Chair, Section Ornamental Plants

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New ISHS Members

ISHS is pleased to welcome the following new members:

NEW INSTITUTIONAL MEMBERS:

Czech Republic: Fosfa Akciová Spolecnost

NEW INDIVIDUAL MEMBERS:

Armenia: Dr. Alvina Avagyan; **Australia:** Ms. Louise Anderson, Mr. David Bardon, Ms. Charlotte Brunt, Robert Cogger, Mr. Ken Davey, Dr. Damian Frank, Mr. Hogan Gleeson, Mr. Digby Growns, Mr. Ron Harris, Mr. Raymond Hudd, Ms. Hian-Lien Ko, Mr. Jim McDonald, Mr. Kerin Smart, Gregory Staader, Don Stirling; **Belgium:** Dr. Frederic Morand; **Brazil:** Ms. Daiane Benemann, Mr. Eduardo Castan, Prof. Dr. Yuri Tavares Rocha; **Canada:** Stephanie Bourget, Dr. Denis Charlebois, Mr. Daniel Fox, Mr. Terry Halligan, Dr. Pierre Hegedus, Gilles Lapointe, Dan McCurdy, Valerie Uffelman; **Chile:** Rodrigo Real, Mr. Matias Rodriguez; **China:** Dr. Chongxing Bu, Mr. Xiaoming Ding, Prof. Dr. Wenwu Guo, Dr. Xianfeng Guo, Dr. Qin Yonghua; **Chinese Taipei:** Chin-Tang Chen, Ms. Shu-Yen Lin, Mr. Min-chin Tseng; **Colombia:** Prof. Dr. Victor Julio Flórez, Prof. Dr. Stanislav Magnitskiy; **Dominican Republic:** Prof. Hector Sanchez Urena; **Egypt:** Mr. Esmail El-Hagrasy, Prof. Dr. Magda Khattab, Ms. Zohra Merabet; **Finland:** Mr. Jukka Tegel; **France:** Mr. Michael Avison, Mr. Alexandre Bouche, Stéphanie Chonville, Mr. Christophe Coelho, Mr. Hubert Coffi, Mr. Max De Bollivier, Michel Leclerc, Jean-Paul Toussaint; **Georgia:** Mr. Konstantine Vekua; **Germany:** Ms. Svenja Bellof, Mr. Daniel Brohm, Dr. Tino Mosler, Wilfried Pagel; **Greece:** Mr. Nikos Lapokonstantakis, Dimitrios Leonidakis, Antonios Thomadakis; **Hungary:** Ms. Julia Gara, Hajnalka Ledó Darázsi, Balint Somogyi; **India:** Mr. D.S. Balachandra Babu, Dr. Suresh Dhumal, Prof. Vijay Dod, Dr. Sanu Jacob, Dr. Robin King, Mr. John Kirubakaran, Mr. Deepak Kumar, Mr. Krishna Reddy Mullangi, Mr. Ramamohan Setlur, Mr. Uday Singh, Mr. Sunjay VS; **Indonesia:** Destika Cahyana; **Iran:** Assist. Prof. Abdolali Shojaeiyan; **Ireland:** Ms. Alison Rae; **Israel:** Eynat Porat, Mr. Uriel Uner, Mr. Joshua Weil; **Italy:** Dr. Flavio Roberto De Salvador, Dr. Luisa del Piano, Dieter Keicher, Dr. Alissa Mattei, Mr. Pablo César Peralta Quesada, Dr. Federico Roncolato, Dr. Fiorella Stagno, Michela Tumiatti; **Japan:** Ms. Rita Andini, Mr. Prem Ananad Joseph, Prof. Dr. Takato Koba, Mr. Sota Koeda, Mr. Ichiro Maekawa, Mr. Sho Ohno, Ms. Makiko Wakita, Prof. Shohei Yamaki; **Kenya:** Mr. Farai Madziva; **Korea (Republic of):** Mr. JeongHoon Cho, Assist. Prof. Jeung-Sul Han, Dr. Ik Hwa Hyun, Dr. Jong Ho Lee; **Malaysia:** Tengku Ab Malik Bin Tengku Maamun; **Mali:** Dr. Abdoulaye Niang; **Mexico:** Mr. Francisco Alberico Lezama, Ruben Justo Martinez, Prof. Dr. Humberto Rodriguez-Fuentes; **Morocco:** Dr. Akka Oulahboub; **Netherlands:** Ms. Didy Arnold, Ellen Beerling, Jan-Jaap Boon, Cor de Jong, Mr. Henri Delsing, Mr. Gert Knoop, Mr. Harry Nijenstein, Mr. Hendrik Rietman, Martijn Sipkema, Mr. Peter Uyttewaal; **New Zealand:** Ms. Indra Ratnayake, Mr. Morgan Rogers; **Nigeria:** Dr. Obi Udengwu; **Norway:** Mr. Kre Auklend, Mr. smund Bjertns, Mr. Sebastian Piotr Mazur; **Poland:** Prof. Dr. Franciszek Adamicki; **Portugal:** Ms. Marta Ms. Baptista, Prof. André Ferreira, Dr. Luis Goulao, Maria Jacinta Silva; **Romania:** Raluca Caulet, Mr. Razvan Marius Dionise, Dr. Ioana Mitre, Prof. Dr. Viorel Mitre; **Russian Federation:** Dr. Sergey Stankevich; **Samoa:** Dr. Walter Vermeulen; **Saudi Arabia:** Mr. Saad Al Sawat; **Serbia:** Dragoslav Drazovic; **Singapore:** Dr. Eng Hock Chia; **South Africa:** Mr. Christopher de Bree, Ms. Erna Grove, Mr. Jacobus Hartman, Mr. Andre Jonker, Mr. Gerrit Nieuwoudt, Mr. Petrus Van Staden; **Spain:** Mr. Jorge Barriobero, Enrique Cadiñanos, Ms. Beatriz Ozcoz, Dr. Erika Roth; **Sweden:** Lena Israelsson, Prof. Dr. Paul Jensén, Christine Larsson; **Tanzania:** Mr. Jürgen Anthofer, Mr. Geoffrey Rutihinda; **Thailand:** Dr. Apiradee Uthairatanaku; **Turkey:** Prof. Dr. Saim Zeki Bostan, Mr. Efe Ener, Prof. Dr. Salih Kafkas, Mr. Engin Taner, Dr. Mehtap Yildiz; **United Arab Emirates:** Mr. Saeed Albahri, Prof. Dr. Ghaleb Ali Alhadrami; **United Kingdom:** Dr. Heather Barrett-Mold, Ms. Stephanie Brattesani, Mr. Philip Hall, Mr. Jafet Hernandez, Prof. Dr. Vernon Heywood, Mr. Andrew Hunt, Mr. Jeremy Peter-Hoblyn, Mr. Geoff Peverall, Dr. Angela Stafford, Susan Vague; **United States of America:** Marcus Adair, Clare Argast, Mr. Armon Azevedo, Anthony Barnett, Ms. Marianne Benveniste, Teresa Bergman, Robert T. Boozer, Todd Cameron, Mr. David Conradt, Mr. Christopher Currey, Michael Dowgert, Mr. Christopher Eisenhart, Touria El-Jaoual, Mr. Steve Fambro, Dr. Dana Faubion, Mr. Jack Feil, Mr. Andrew Frerichs, Dr. Yogbert Gafootian, Mr. Bernard V. Gauthier Jr., Dr. John Greaves, Mr. Cesar Herrera, Robert Hilles, Charlie Jancic, Shawn Johnson, Dr. George Kantor, Dr. Etienne Kaszas, James Keach, Coleen Kennedy, Tim Logan, Eric Ludovici, Mr. Earl Lumpkins, Dr. Karen Maguylo, Ms. Margaret Mass, Mark McDougald, Mr. James Merrick, Joseph Musumeci, Joseph O'Brien, Ken Owens, Ms. Hyungsun Park, Mr. David Plant, Sandra Power, Mr. Mike Raymond, Ms. Eda Reinot, Mr. Jeffers Richardson, Dr. Nancy Robertson, Mr. Thomas Romano, Dr. Robert Royce, Nicole Rud, Terry Russell, John Schoenecker, Bharat Shah, Les Sherrill, Mr. Zane Smith, Frank Stonaker, Dr. Keith Striegler, Barton Switzer, Betty Taylor, Don Wade, Bob Walker, Dr. Tianbao Yang; **Venezuela:** Prof. Dámaso Bautista Arellano, Mr. Diego Lozada; **Vietnam:** Mr. Lewis Nguyen, Mr. Bao Phan Do Duy

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YEAR 2010

- April 8-12, 2010, Sanya, Hainan Island (China): **IX International Mango Symposium.** Info: Dr. Ping Lu, PO Box 42238, Casuarina, NT 0810, Australia. Phone: (61)889 271547, Fax: (61)889 271547, E-mail: mango2010sanya@yahoo.com or Dr. Qiubo Chen, Chinese Academy, Tropical Agricultural Sciences, Danzhou, Hainan Province 571737, China. Phone: (86)89823300207/196, Fax: (86)89823300157, E-mail: chenqb2003@21cn.com Web: http://www.mango2010.cn/

- April 19-21, 2010, Shiraz (Iran): **International Medicinal and Aromatic Plants Symposium 2010: IMAPS2010.** Info: Prof. Morteza Khosh-Khui, Department of Horticulture, College of Agriculture, Shiraz University, Shiraz, Iran. Phone: (98)7116243978, Fax: (98)7116289017 or Dr. Jalal Ghaemghami, Director of SHMEN Inc., PO Box 320172, West Roxbury, MA 02132, United States of America. Phone: (1)6176782157, Fax: (1)3174690024 Web: http://www.imaps2010.com/

- May 3-6, 2010, Antakya-Hatay (Turkey): **III International Symposium on Loquat.** Info: Prof.Dr. A. Aytekin Polat, Mustafa Kemal University, Faculty of Agriculture, Dept. of Horticulture, Antakya Hatay, 31034, Turkey. Phone: (90)3262455845/1088, Fax: (90)3262455832, E-mail: apolat@mku.edu.tr E-mail symposium: loquat2010@mku.edu.tr Web: http://loquat2010.mku.edu.tr/

- NEW June 20-23, 2010, Estoril (Portugal): **XII International Symposium on the Processing Tomato - IX World Congress on Processing Tomato.** Info: Dr. Antonio Mexia, ISA, Tapada da Ajuda, 1349-017 Lisboa, Portugal. Phone: (351)13638161, Fax: (351)13635031, E-mail: amexia@isa.utl.pt or Prof. Dr. Montaña Cámara, Dpto. Nutrición y Bromatología II, Facultad Farmacia. UCM, Plaza Ramón y Cajal sn, 28040 Madrid, Spain. Phone: (34) 913941808, Fax: (34) 913941799, E-mail: mcamara@farm.ucm.es

- July 4-8, 2010, Kuala Lumpur (Malaysia): **III International Symposium on Improving the Performance of Supply Chains in the Transitional Economies.** Info: Dr. Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au or Dr. Nolila Mohd Nawi, Universiti Putra Malaysia, 43400 UPM, Selangor Serdang, Malaysia. E-mail: nolila@agri.upm.edu.my Web: http://agrienvi.curtin.edu.au/about/conferences/ishs_2010/

- NEW July 13-15, 2010, Johor (Malaysia): **VII International Pineapple Symposium.** Info: Tengku Ab Malik Bin Tengku Maamun, Director Horticulture Research Ctr., MARDI Headquarters, GPO Box 12301, 50774 KUala Lumpur, Malaysia. Phone: (60)389437263, Fax: (60)389487590, E-mail: tamtm@mardi.gov.my E-mail symposium: ips2010_sec@mardi.gov.my Web: https://anjungnet.mardi.gov.my/Conference.nsf/PineApple?OpenPage

- July 25-30, 2010, Ischia, Naples (Italy): **III International Symposium on Tomato Diseases.** Info: Prof.Dr. Aniello Crescenzi, 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: aniello.crescenzi@unibas.it E-mail symposium: info@3istd.com Web: http://www.3istd.com/

- 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: bir1@nysaes.cornell.edu Web: http://www.grapebreeding2010.com

- August 2-4, 2010, Bangkok (Thailand): **Asia Pacific Symposium on Postharvest Research Education and Extension.** Info: Dr. Sirichai Kanlayanarat, King Mongkut's University of Technology, Thonburi, Division of Postharvest Technology, Thungkru, Bangkok 10140, Thailand. Phone: (66)2 470 7720, Fax: (66)2 452 3750, E-mail: sirichai.kan@kmutt.ac.th

- August 16-20, 2010, Warsaw (Poland): **XII International Workshop on Fire Blight.** Info: Dr. Piotr Sobiczewski, Res. Inst. of Pomology, Ul. Pomologiczna 18, 96-100 Skierniewice, Poland. Phone: (48)46 8332021, Fax: (48)46 8333228, E-mail: piotr.sobiczewski@insad.pl Web: http://www.fireblight2010.pl/

- August 22-27, 2010, Lisbon (Portugal): **XXVIII International Horticultural Congress - IHC2010.** Info: Prof. Dr. António A. Monteiro, Instituto Superior de Agronomia, Technical University of Lisbon, Tapada da Ajuda, 1349-017 Lisboa, Portugal. Phone: (351)213653451, Fax: (351)213623262, E-mail: amonteiro@isa.utl.pt or Dr. Víctor Galán 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

SYMPOSIA AT IHC LISBOA 2010

- August 22-27, 2010, Lisbon (Portugal): **Symposium Berries: From Genomics to Sustainable Production, Quality and Health (XXVIII International Horticultural Congress - IHC2010).** Info: Prof. Dr. Bruno Mezzetti, Dip.di Scienze Amb. e delle Prod.Veg., Università Politecnica delle Marche, Via Brecce Bianche, Ancona 60100, Italy. Phone: (39)0712204933, Fax: (39)0712204858, E-mail: b.mezzetti@univpm.it or Mr. Pedro N. Brás Oliveira, Departamento Prod. Agricola, Av.da República, Nova Oeiras, 2784-505 Oeiras, Portugal. Phone: (351)214403500, Fax: (351)214411797, E-mail: pnbo@mail.telepac.pt E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Postharvest Technology in the Global Market (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Marita I. Cantwell, Mann Laboratory, Department of Plant Sciences, One Shields Avenue, Davis, CA 95616-8746, United States of America. Phone: (1)5307527305, Fax: (1)5307524554, E-mail: micantwell@ucdavis.edu or Prof. Dr. Domingos Almeida, Faculdade de Ciências, Universidade Porto, Rua Campo Alegre, 823, 4150-180 Porto, Portugal. Phone: (351)964310788, Fax: (351)222008628, E-mail: dalmeida@fc.up.pt E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Symposium Greenhouse 2010: Environmentally Sound Greenhouse Production for People (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Nicolas Castilla, IFAPA-Centro Camino de Purchil, Camino de Purchil, 55, Apartado 2027, 18004 Granada, Spain. Phone: (34)958895309, Fax: (34)958895203, E-mail: ncastill@arrakis.es or Prof. Dr. Olaf Van Kooten, Horticultural Production Chains Group, Marijkeweg 22, 6709 PG Wageningen, Netherlands. Phone: (31)317-484096, Fax: (31)317-484709, E-mail: olaf.vankooten@wur.nl or Dr. Sadanori Sase, National Institute for Rural Engineering, Kannondai 2-1-6, Tsukuba, Ibaraki 305-8609, Japan. Phone: (81)298387594, Fax: (81)298387609, E-mail: sase@affrc.go.jp E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Symposium Mediterranean Fruits and Nuts: Plant Material and Cropping Issues of Mediterranean Fruits and Nuts for Sustainable Production (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Ignasi Batlle Caravaca, IRTA: Mas de Bover, Ctra. Reu, El Morell, km 3,8, 43120 Constantí (Tarragona), Spain. E-mail: ignasi.batlle@irta.cat or Prof. Tiziano Caruso, Dipartimento Colture Arboree/Fac.Agraria, Univ.degli Studi di Palermo, Viale delle Scienze, 90128 Palermo, Italy. Phone: (39)0916521100, Fax: (39)0916521098, E-mail: ticaruso@unipa.it E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Emerging Health Issues in Fruits and Vegetables (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Yves Desjardins, Faculty of Agriculture, Department of Plant Science, Laval University, Quebec, QC G1K 7P4, Canada. Phone: (1)4186562131x2359, Fax: (1)4186567856, E-mail: yves.desjardins@plg.ulaval.ca or Dr. Francisco Tomás-Barberán, CEBAS-CSIC, Laboratorio de Fitoquímica, Campus Univ.de Espinardo - PO Box164, Murcia 30100, Spain. Phone: (34)968 396334, E-mail: fatomas@cebas.csic.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Symposium Olive Trends: from the Olive Tree to Olive Oil: New Trends and Future Challenges (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Manuel Pedro Fevereiro, ITQB, Quinta do Marques, Apt° 127, 2780 Oeiras, Portugal. Phone: (351)214469447, Fax: (351)214411277, E-mail: psalema@itqb.unl.pt or Dr. Joan Tous Martí, IRTA: Mas de Bover, Ctra. Reus, El Morell, km 3,8, 43120 Constantí (Tarragona), Spain. Phone: (34)977328424, Fax: (34)977344055, E-mail: joan.tous@irta.cat or Dr. Riccardo Gucci, Dipartimento di Coltivazione, e Difesa delle Specie Legnose, Via del Borghetto 80, 56124 Pisa, Italy. Phone: (39)050571550 Fax: (39)050544420, E-mail: rgucci@agr.unipi.it E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Ornamentals: Diversity and Opportunities in Ornamental Horticulture (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Julie A. Plummer, Senior Lecturer, Plant Sciences, Univ.of Western Australia, 35 Stirling Hwy, Crawley, WA 6009, Australia. Phone: (61)893801786, Fax: (61)893801108, E-mail: jplummer@cyllene.uwa.edu.au or Dr. Pedro Cermeño Sacristán, Centro de Inv. Las Torres, Apdo Correos Oficial, 41200 Alcalá del Río, Sevilla, Spain. Phone: (34)955 04 55 80, Fax: (34)955 04 56 25, E-mail: pedro.cermeno@juntadeandalucia.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Symposium Bananas and other Tropical Fruits under Tropical Conditions: Challenges and Innovative Solutions (XXVIII International Horticultural Congress - IHC2010).** Info: Hamide Gubbuk, Akdeniz University, Faculty of Agriculture, 7059 Antalya, Turkey. E-mail: gubbuk@akdeniz.edu.tr or Prof. Dr. Jens N. Wuensche, University of Hohenheim, Dept.Special Crops&Crop Physiology, Inst. Fruit Sci. (370d), Emil-Wolff-Str. 25, 70599 Hohenheim, Germany. Phone: (49)711-459-2368 or 160-9700-6229, Fax: (49)711-459-2351, E-mail: jnwuensche@uni-hohenheim.de or Dr. Domingo Haroldo Reinhardt, Embrapa Cassava & Tropical Fruits, Caixa Postal 7, 44380-000 Cruz das Almas, BA, Brazil. Phone: (55) 75 3621 8002, Fax: (55) 75 3621 8097, E-mail: dharoldo@cnpmf.embrapa.br E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Symposium Viticulture and Climate: Effect of Climate Change on Production and Quality of Grapevines and their Products (XXVIII International Horticultural Congress - IHC2010).** Info: Prof. Dr. Hipolito Medrano, Universitat de les Balears, Departament de Biologia, Crta Valldemossa Km 7,5, Palme de Mallorca 07071, Spain. Phone: (34)971173168, Fax: (34)971173184, E-mail: hipolito.medrano@uib.es or Prof. Dr. Ben Ami Bravdo, Hebrew Univ. of Jerusalem, Faculty of Agriculture, PO Box 12, Rehovot 76-100, Israel. Phone: (972)89489094 or (972)522608068, Fax: (972)89462817, E-mail: bravdo@agri.huji.ac.il E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Symposium ClimWater 2010: Horticultural Use of Water in a Changing Climate (XXVIII International Horticultural Congress - IHC2010).** 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 or Prof. Dr. Maria Isabel F.R. Ferreira, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Tapada de Ajuda, 1349 - 017 Lisboa, Portugal. Phone: (351)213653476, Fax: (351)213621575 E-mail: isabelferreira@isa.utl.pt E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Symposium Horticulture for Development (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Rémi Kahane, Global Horticultural Initiative, c/o AVRDC, PO Box 10, Duluti - Arusha, Tanzania. Phone: (255)272553093, Fax: (255)272553125, E-mail: rkahane@globalhort.org or Dr. Lusike Wasilwa, KARI, Horticulture and Industrial Crops, PO Box 57811, Nairobi 00200, Kenya. Phone: (254)20 418 3301, Fax: (254)20 418 3344, E-mail: lusikewasilwa@hotmail.com or Luis Manuel Ferro Correia, Rua Centro Transmontanto de S. Paulo n° 69, 5370-381 Mirandela, Portugal. E-mail: appitad@clix.p E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Symposium ISAFRUIT: Increasing Consumption of Fruit by Meeting Consumer Needs: Science Overcomes the Bottlenecks (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Ole Callesen, Aarhus Universitet, Fac.of Agric.Sciences - Dept. of Hort., Kirstinebjergvej 10, 5792 Årslev, Denmark. Phone: (45)8999 3265, Fax: (45)8999 3493, E-mail: ole.callesen@agrsci.dk or Joan Bonany, Mas Badia, 17134 La Tallada, Spain. Phone: (34)972780275, Fax: (34)972780517 E-mail: joan.bonany@irta.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Genetic Resources: New Tools for the Conservation and Management of Genetic Resources in Horticulture (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Kim Hummer, USDA ARS NCGR, 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 or Dr. Maria Jose Diez, Univ. Polytechnica de Valencia, Department of Biotechnology, Camino de Vera 14, 46022 Valencia, Spain. Phone: (34)963877421, Fax: (34)963877429, E-mail: mdiezni@btc.upv.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Symposium on Horticultural Crop Genomics (XXVIII International Horticultural Congress - IHC2010).** Info: Dr. Kevin Folta, University of Florida, Horticultural Sciences Dept., 1301 Fifield Hall, Gainesville, FL 32611, United States of America. Phone: (1)352-392-1928 x269, E-mail: kfolta@ifas.ufl.edu or Prof. Dr. Manuel Talón, IVIA, Centro Genomica, Carretera Moncada - Náquera, Km. 4,5, 46113 Moncada (Valencia), Spain. Phone: (34)96 342 40 00, Fax: (34)96 342 40 01, E-mail: mtalon.ivia.es E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org/

- August 22-27, 2010, Lisbon (Portugal): **Quality-Chain Management of Fresh Vegetables: From Fork to Farm (XXVIII International Horticultural Congress - IHC2010).** Info: Prof. Dr. Eduardo Rosa, Univ.Tras os Montes e Alto Douro, Apartado 202, 5001 Vila Real, Portugal. Phone: (351)259320446, Fax: (351)259320480, E-mail: erosa@utad.pt or Dr. Paulo César Tavares de Melo, ABH President, IAC - Centro de Horticultura, Caixa Postal 28, CEP13.012-970 Campinas SP, Brazil. Phone: (55)1932415188x374, Fax: (55)1932415188x374, E-mail: pctmelo@esalq.usp.br E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **X International Protea Research Symposium (XXVIII International Horticultural Congress - IHC2010).** Info: Kenneth W. Leonhardt, University of Hawaii, 3190 Maile Way, Rm 102, Honolulu, HI 96822-2232, United

States of America. Phone: (1)8089568909, Fax: (1)8089563894, E-mail: leonhard@hawaii.edu or Dr. Maria José Leandro, Europrotea Sociedade Agrícola, Rua Actor Isidoro nº 32 R/c Esqº, 1900-019 Lisboa, Portugal. Phone: (351)283 961 680, Fax: (351)283 961 604, E-mail: mleandro938@gmail.com E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Organic Horticulture: Productivity and Sustainability (XXVIII International Horticultural Congress - IHC2010).** Info: Prof. Dr. Uygun Aksoy, Ege University, Faculty of Agriculture, Department of Horticulture, 35100 Bornova - Izmir, Turkey. Phone: (90)2323884000x2742, Fax: (90) 2323881864 , E-mail: uygun.aksoy@ege.edu.tr or Prof. Dr. Isabel de Maria C.G. Mourão, Escola Superior Agrária, Convento de Refóios, 4990-706 Ponte de Lima, Portugal. Phone: (351)258909740, Fax: (351)258909779, E-mail: isabelmourao@esa.ipvc.pt E-mail symposium: info@ihc2010.org Web: http://www.ihc2010.org

- August 22-27, 2010, Lisbon (Portugal): **Symposium HortGen: Genetically Modified Horticultural Crops, from the Lab to the Field (XXVIII International Horticultural Congress - IHC2010).** Info: Prof. Dr. Richard Litz, Tropical Research Education Center, University of Florida, 18905 SW280 St, Homestead FL 33031-3314, United States of America. Phone: (1)305 246 7001, Fax: (1)305 246 7003, E-mail: rel@ifas.ufl.edu or Fernando Pliego Alfaro, University of Malaga, Department of Plant Biology, Campus de Teatinos S/N, 29071 Malaga, Spain. E-mail: ferpliego@uma.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-VIV, Via dei Fiori 8, 51012 Pescia (PT), Italy. Phone: (39)0572451033, Fax: (39)0572453309, E-mail: antonio.grassotti@entecra.it or Dr. Gianluca Burchi, CRA-VIV - Unità di Ricerca per il Vivaismo , e la Gestione del Verde Ambientale, ed Ornamentale, Via dei Fiori 8 - 51012 Pescia (PT), Italy. Phone: (39)0572451033, Fax: (39)0572453309, E-mail: gianluca.burchi@entecra.it E-mail symposium: info@symplitaly2010.com Web: http://www.symplitaly2010.com/

- September 1-3, 2010, Antwerp (Belgium): **International Strawberry Convention on Research & Sustainable Production Leading to Successful Marketing.** Info: Jan Engelen, Veiling Hoogstraten, Loenhoutseweg 59, 2320 Hoogstraten, Belgium. Phone: (32)33400211, Fax: (32)33147844, E-mail: jan.engelen@veilinghoogstraten.be

- September 5-9, 2010, Sofia (Bulgaria): **International Symposium on Plum Pox Virus.** Info: Dr. Vania Kamenova, AgroBioInstitute, 8 Dragan Tzankov Blvd., 1164 Sofia, Bulgaria. Phone: (359)2 963 53 09, E-mail: ivanka.kamenova@yahoo.com

- September 12-17, 2010, Faenza (Italy): **VII International Symposium on Kiwifruit.** Info: Prof. Guglielmo Costa, Ordinario di Arboricoltura Generale, Dipartimento di Colture Arboree, 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.avenuemedia.eu/source/congressi/congressi_2010/7th_Symposium_Kiwifruit/indice_7th_International_Symposium_Kiwifruit.html

- September 20-21, 2010, Wien (Austria): **V International Phylloxera Symposium.** Info: Prof. Dr. Astrid Forneck, Universität für Bodenkultur, Wien, Institute for Pomology and Viticulture, Peter-Jordan Str. 82, A-1190 Vienna, Austria. Phone: (43)1476543441, E-mail: astrid.forneck@boku.ac.at or Dr. Michaela Griesser, Dept. Applied Plant Sci. & Plant Biol., Institute of Horticulture, Peter Jordan Strasse 82, 1190 Wien, Austria. E-mail: michaela.griesser@boku.ac.at Web: http://www.viticulture-research.com/

- October 17-22, 2010, Agadir (Morocco): **VII International Congress on Cactus Pear and Cochineal.** Info: Dr. Akka Oulahboub, Moroccan Assoc. Cactus Development, Av. Mohamed BeLaarbi Alaou, BP 6598, Rabat Instituts , Rabat, Morocco. Phone: (212)537776450, Fax: (212)537774667, E-mail: aoulahboub@yahoo.fr

- November 11-12, 2010, Launceston, Tasmania (Australia): **International Symposium on Pyrethrum, The Natural Insecticide: Scientific and Industrial Developments in the Renewal of a Traditional Industry.** Info: Mr. Brian Chung, Botanical Resources Australia, PO Box 852, Sandy Bay, Hobart, TAS 7006, Australia. Phone: (61)362244511, Fax: (61)362244473, E-mail: bchung@pyrethrum.com.au

- November 21-25, 2010, Campinas (Brazil): **I International Symposium on Genetic Research of Bamboos and Palms and III International Symposium on Ornamental Palms.** Info: Dr. Antonio Fernando Tombolato, Instituto Agronomico, Avenida Barão de Itapura 1481, Caixa Postal 28, 13012-970 Campinas SP, Brazil. Phone: (55)1932415188, Fax: (55)1932417570, E-mail: tombolat@iac.sp.gov.br or Prof. Kathia Pivetta, Rodovia Carlos Tonanni, Km 5, Departamento de Horticultura, 14870-000 Jaboticabal, Brazil. Phone: (55)163232500, Fax: (55)163224275, E-mail: kathia@fcav.unesp.br Web: http://www.infobibos.com/symbampalm/

- November 22-26, 2010, Kingston (Jamaica): **I International Symposium on Tropical Horticulture.** Info: Prof. Dr. Noureddine Benkeblia, The University of the West Indies, Department of Life Sciences, Mona Campus, Kingston 7, Jamaica. Phone: (1)8769271202, Fax: (1)8767024203, E-mail: noureddine.benkeblia@uwimona.edu.jm Web: http://ocs.mona.uwi.edu/ocs/index.php/th/th1

- November 23-26, 2010, General Roca (Rio Negro) (Argentina): **XI International Pear Symposium.** Info: Dr. Enrique E. Sanchez, INTA Alto Valle, Casilla de Correo 782, 8332 General Roca, Rio Negro, Argentina. Phone: (54)29414439000, Fax: (54)2941439063, E-mail: esanchez@correo.inta.gov.ar Web:

For updates logon to www.ishs.org/calendar

Available Issues of *Acta Horticulturae*

Due to lack of space in this issue we refer to www.actahort.org for an updated list of all titles (in print or ActaHort CD-rom format)

Acta Number	Acta Title	Acta Price (EUR)
852	IV International Symposium on Ecologically Sound Fertilization Strategies for Field Vegetable Production	85
851	II International Symposium on Papaya	130
850	III International Symposium on Saffron: Forthcoming Challenges in Cultivation, Research and Economics	79
849	II International Symposium on Guava and Other *Myrtaceae*	94
848	II International Humulus Symposium	80
847	IX International Symposium on Postharvest Quality of Ornamental Plants	92
846	VII International Workshop on Sap Flow	90

Chronica Horticulturae
Author Information

Chronica Horticulturae is the quarterly publication of the International Society for Horticultural Science (ISHS) and is received by all members of the Society and numerous libraries throughout the world. Members and non-members are urged to contribute articles for consideration. However, it needs to be understood that *Chronica* is not to be construed as a scientific journal that publishes original research. Research articles appropriate for *Acta Horticulturae* or horticultural science journals are usually inappropriate for *Chronica*. We seek horticultural articles of interest to a broad audience composed of ISHS members and the horticultural, scientific, and academic communities.

Chronica Horticulturae is currently made up of as many as eight sections as follows:

News & Views from the Board. This section is usually confined to editorials from Board Members as well as general announcements of the Society.

Issues. Articles of a broad focus that often involve controversial topics related to horticulture including broad social issues and economic development are appropriate for this section. These articles are intended to stimulate discussion. Often, guest writers are asked to contribute articles.

Horticultural Science Focus. This section is intended for in-depth articles on a topic of horticulture, generally, but not always, scientific in nature. Many articles are mini-reviews, and bring current topics of interest to the horticultural community up to date. We encourage these articles to be illustrated.

Horticultural Science News. Shorter current articles about particular topics including horticultural commodities and disciplines are welcome.

History. This section includes articles on the history of horticulture, horticultural crops, and ISHS.

The World of Horticulture. This section highlights articles on horticultural industries and research institutions of particular countries or geographic regions throughout the world. They are meant to be profusely illustrated with figures and tables. This section also includes book reviews, which are requested by the Science Editor. Members who wish to recommend a book review should arrange for a copy of the book to reach the Secretariat.

Symposia and Workshops. Meetings under the auspices of ISHS are summarized, usually by a participant of the meeting. These articles are delegated by the symposium organizers.

News from the ISHS Secretariat. This section contains information on membership, memorials for deceased ISHS members, and a calendar of ISHS events. Brief memorials (up to 500 words) should be sent to the Secretariat.

Authors who wish to contribute articles for *Chronica* should contact headquarters and their request will be transmitted to the Science Editor or another appropriate editor. Authors should be aware that most articles should have a broad international focus. Thus, articles of strictly local interest, are generally unsuited to *Chronica*. Illustrated articles are usually 1500 to 5000 words. There are no page charges for *Chronica Horticulturae*. Photographs submitted should be of high resolution. We encourage electronic submission. Send articles or ideas for articles to:

Jules Janick, Science Editor**, janick@purdue.edu**
Kelly Van Dijck, Associate Editor, **kelly.vandijck@ishs.org**

ISHS

Miklos Faust Travel Award for Young Pomologists

The Miklos Faust International Travel Award for Young Pomologists is soliciting applications from young pomologists for financial assistance to travel and attend the International Horticultural Congress in Lisbon, Portugal on August 22-27, 2010. Established by the American Society for Horticultural Science (ASHS) and the International Society for Horticultural Science (ISHS), the Award provides financial assistance to scientists involved in fruit science research to attend the quadrennial International Horticultural Congress (IHC). The Award also supports travel and attendance at the Annual Conference of the ASHS occurring midway between each Congress.

Preference is given to young scientists (less than 40 years old) who have completed (or are actively pursuing) their doctoral degree. Preference is also given to scientists who will travel internationally following receipt of this Award. This year award, the amount of $2000 will be given to two individuals. The guidelines for applicants and an Application Form can be found at www.ashs.org and at www.ishs.org. Applications will be received until May 1 and two winners will be notified by June 1, 2010. Applications will be judged by a panel of three senior scientists selected from the Faust Award Board of Directors.

This Award honors Dr. Miklos Faust's significant contributions to the science and practice of fruit crops horticulture and to foster scientific exchange and collaboration within the world community of fruit crops researchers. Miklos Faust received a PhD degree in Pomology from Cornell University. He devoted his professional career with the U.S. Department of Agriculture, Agricultural Research Service to studies on fruit tree physiology that resulted in significant and lasting contributions to modern fruit science. A native Hungarian and a distinguished scholar, Miklos was keenly aware of the importance of international science exchange and cooperation for the advancement of modern fruit production, protection and genetic improvement.

After Toronto, Canada and Seoul, Korea, this will be the third time young pomologists supported by the Miklos Faust International Travel Award will be attending the IHC.

Dariusz Swietlik
Chairman of the Board
The Miklos Faust International Travel
Award for Young Pomologists

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