Chronica Horticulturae

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CHRONICA HORTICULTURAE

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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: Barn owl (*Tyto alba*) grasping a field vole (*Microtus socialis*), a form of organic rodent control in orchards. See article p. 7. (Photo by Amir Ezer)

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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Erratum

Now access the *Journal of Horticultural Science & Biotechnology* electronically at: www.jhortscib.com for general information, and at: www.jhortscib.org for back issues to Volume 1 Issue 1 (1919). *Chronica Horticulturae* 50(1), page 8, contained an error in the webpage address, for which we apologise.

Science: The Core of ISHS

Ian J. Warrington, ISHS Vice President

Ian J. Warrington

The heart of the International Society for Horticultural Science has always been deeply embedded in its scientific program and that commitment is likely to remain firm for many decades to come. The original mandate for the ISHS was to run the quadrennial congresses and that can be traced back to The First International Horticultural Congress that was held in Brussels, Belgium in 1864 (Sirks, 2009). The mandate was secured more recently from 1959 when the Society was formally constituted. An additional element within this mandate was to improve collaboration and the interaction of horticultural scientists around the world.

The International Horticultural Congress in Lisbon this year will be the 28th in a series that goes back to Paris in 1889. About three-quarters of these Congresses have been held in Europe but the 2nd, 17th and 22nd were held in the USA, the 18th in Israel, the 20th in Australia, the 24th in Japan, the 26th in Canada, and the 27th in Korea.

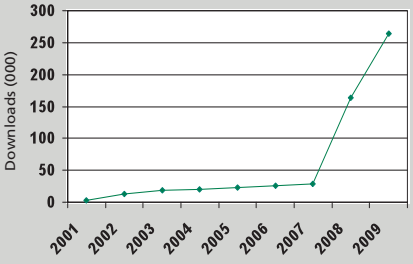
The first publication of a volume of *Acta Horticulturae* occurred in 1963 soon after the Society was formally constituted – with *Acta* having always been regarded as the publication of a proceedings from an ISHS-sponsored symposium (Zimmerman, 2009). Over 850 Actas have now been published with the growth in volumes increasing progressively over the past 5 decades. Impressively, the articles published in *Acta* are widely cited and are heavily downloaded from the ISHS on-line website PubHort.

The present Board and Executive Committee have worked very effectively over the past 8 years to build on the strengths of the Society's scientific program. There are now more than 100 active working groups within 10 crop-related Sections and 14 discipline-related Commissions. In 2010, the ISHS (including the activities of the International Horticultural Congress) will host a total of 47 scientific symposia. Increasingly, many of these are in partnership with related horticultural science and industry groups who see strong merit in being part of the organisational and support structures provided by the ISHS.

There is, however, a lot more that can be done to build on recent achievements. These challenges can be summarised as follows:

ACTA DOWNLOADS

In today's society we increasingly take for granted the importance of electronic communication. It was, therefore, a progressive decision by the ISHS Board in 2006-2007 to offer subscriptions that included electronic access to volumes of *Acta Horticulturae* for only a marginal increase in annual subscription costs. In spite of concerns at the time, this did not result in any negative impact on the Society's financial revenues and a continuation of the policy very quickly resulted in an increase in the number of downloads. Concurrently with this growth in access to *Acta Horticulturae*, there was an enhanced number of sales of extra downloads to members, revenue from sales to non-members and an increased number of new membership subscriptions as others appreciated the benefits of joining the Society. The demand for *Acta Horticulturae* from libraries also increased. Overall, therefore, these changes have significantly increased both the status and the impact of *Acta Horticulturae*.



GREATER COORDINATION OF SYMPOSIA

Currently, the date, location, and theme of a symposium are usually decided during a working group meeting at the current symposium of a series. While in many cases there is a satisfactory outcome, in other cases clashes in location, timing or subject matter can be frustrating to registrants who have to prioritise amongst the options available. Attending all symposia in the ISHS schedule is no longer possible. The Executive Committee currently reviews annually the future four-year calendar of scientific events and needs to intervene more forcefully in future in order to achieve better structure to the overall scientific programme within the ISHS.

GREATER COVERAGE OF BOTH CROP COMMODITY AND SCIENTIFIC DISCIPLINES

The ISHS has, in recent years, introduced a number of new disciplines and crops to the scientific program, such as Fruits and Vegetables and Health, Sustainability through Integrated and Organic Horticulture, and Citrus. There are clearly other avenues for the ISHS to be more inclusive. These deserve development either through greater partnerships with those already covering the crop or discipline, or through the leadership of the Executive Committee driving these new scientific initiatives forward. The Society remains weak in the interface with entomology and yet pest control is one of the key challenges with regard to minimising spray residues and producing healthier products. Similarly crops like dates and mushrooms are on the agenda but have not been the subjects of ISHS symposia to date. The incoming Executive Committee, with around 50% new membership of the Chairs, is encouraged to find the time and energy to not only run their own portfolios but to steward in some of these new initiatives as well.

STRONGER PARTNERSHIPS WITH ALLIED ORGANIZATIONS

A real challenge for the incoming Board of Directors will be to see that the partnerships that have been committed to over the past decade are supported and encouraged to grow. This will require a dedicated effort and a vision to secure the available synergies. Opportunities exist with diverse crops and disciplines including mushrooms, citrus, peat, potato, and plant

propagation. These provide a tremendous opportunity to further broaden the scientific program and also to secure greater private sector and industry involvement with the ISHS.

LEADERSHIP IN GLOBALLY SIGNIFICANT ISSUES

There are many topics that are assuming significant coverage internationally and which are attracting the attention of both consumers and policy makers. The ISHS has the opportunity to provide global leadership in the debate of topics such as water use in irrigation for horticultural crops; the true implications of actual (rather than claimed) sustainable horticultural production practices; experiences with genetically-modified horticultural crops in both developed and developing countries; the true meaning of carbon footprints; and the actual benefits of fruit and vegetables for health. Despite the value of the scientific symposia that have been held on these topics over the years there is the opportunity to lift our engagement to another level. I suggest the hosting of summit conferences and advanced level workshops that would involve the combined input of senior scientists, producers, policy makers and politicians to openly discuss and debate these important issues that are facing the world. Such meetings would provide a factual basis for that debate and allow policy to be developed at various levels. We need to engage more with others and not just talk amongst ourselves! The creation of an ISHS Global Food Forum would be an exciting development in the progression of the Society.

Such initiatives would require newly-aligned support funding, perhaps financing from benefactors rather than sponsors in order to avoid accusations of bias. They would require much greater media management than occurs with the current symposia and they would definitely demand experienced and careful leadership. I foresee that such activities would position the ISHS as a globally-relevant Society and would provide advocacy for the important achievements and contributions that are made by our profession.

References

Sirks, M.J. 2009. The internationalization of horticulture science. (Reprinted from *Chronica Horticultuae* 1(1):1-4) Chronica Hort. 49(3):11-13.

Zimmerman, R.H. 2009. Fifty years of progress for ISHS. Chronica Hort. 49(3):5-10.

Sed Quis Custodiet Ipsos Custodes?[1]

Geoffrey R. Dixon and Georg J. Noga

Recent turmoil in the world's financial and banking sectors has emphasized the need for careful checking and oversight of the affairs of organizations and institutions. Relying solely on direct systems of control from external auditors through executives to internal boards of management may not adequately identify risks or wisely test medium- to longer-term policies. Fortunately, the International Society for Horticultural Science's (ISHS) statutes provides for just such systems of checking and oversight. The Board of Directors through the Treasurer in collaboration with the Executive Director and his staff deliver financial accounts and other relevant information to an external auditing company (currently Ernst & Young) as required by law. The external auditors report back to the Board on ISHS's financial and investment position. From time to time, normally at Council meetings and the General Assembly, the Treasurer reports on behalf of the Board to the membership regarding the health of the Society's affairs. Unavoidably, these reports are delivered at relatively extended intervals of time. Nonetheless, consideration of issues of current and future significance form a major part of the Treasurer's reports in addition to retrospective commentating. Thus for example, future budgeting policies are explained and specific policies such as the changes in fee structures were placed for discussion by Council well in advance of their suggested implementation. The Board's care of the Society's affairs is typified by its caution with regard to policies for coping with the world economic crisis. Well in time to adjust the Society's direction the Board produced budgets designed to cope with "business-as-usual", "mild crisis" and "severe crisis" situations. The Board is well supplied with financial information on a very regular basis and the Treasurer receives monthly statements which are discussed with the Executive Director. Consequently, there is active monitoring of the Society's finances by the Board via dialogue between the Executive Director and the Treasurer.

The 'wise men' who formulated the current ISHS statutes recognized however, that checking and questioning of the Society's affairs by an independent source was also desirable in order to introduce additional oversight in the interests of ISHS members. This reflects the worldwide stature of ISHS and the interests of its international membership. Consequently, Council appoints two of its members to serve as Internal Auditors. Their function is to review and comment on each annual report received from the External Auditors. They raise issues of concern, congratulate good practice and consult extensively and intensively with the Executive Director and his staff and then report to the Treasurer and other Board members as quickly as possible after each annual External Audit has been completed. By this eminently sensible mechanism the membership is closely represented in the auditing processes at a stage where issues may be reviewed in advance of decision-making and real changes can be brought about.

Here we, the Internal Auditors, report on the major issues of concern and those of good practice which have been the subject of our attention and scrutiny over the period 2006 to 2010. Very obviously much has changed in world affairs in this period such that some issues which seemed of major significance in 2007 are now largely irrelevant while others have gained overwhelming dominance. It is a measure of the flexibility of the Society's management and the Internal Auditing system that the focus of interest can shift rapidly. This is aided by having each External Auditors' report made available as soon as received, formulating questions and then meeting in Leuven for an intensive series of discussions.

A key feature of all four Internal Audits has been the need to consider steps taken by the Board and the Executive Director to minimize

1 But who is to guard the guards themselves? Satires no.6 line 347, Juvenal AD c. 60-c. 130.

financial and corporate risks. Early considerations focused on risks that might arise from internet development, publications, meetings and promotional activities at congresses. We recognized the strenuous efforts of management which keep expenses in balance with approved budgets and guide the Investment Portfolio very effectively. Investments are geared to a defensive strategy which reduces income but avoids undue risk. The Internal Auditors endorsed management's proposals whereby the investments of ISHS were divided as two amounts in the portfolios thereby further spreading risk. This is a general feature of charity investments and engenders added security.

The Society's core businesses are in:

- publishing (hard copy and electronic);
- providing a platform on which members build symposia and congresses;
- servicing members' interests;
- enhancing the international appreciation of horticulture and horticultural science as a powerhouse for public good and wealth creation.

INCOME AND EXPENDITURE

Financial health is the bedrock upon which the Society bases all its other activities. Consistently over the period 2006 to 2009 there has been a surplus of income over expenditure. This results from skilful management by the Treasurer and other Board members and is supported by the hard work of the Executive Director and his dedicated Team. The Society has a strong asset base and produces surpluses which are of acceptable size in a business context, particularly when the provisions laid aside against known potential risks are taken into account. There has been rigorous control of dead-stock such as back issues of *Acta Horticulturae*.

BANKING

By early 2008 the Treasurer, other Board members and Executive Director were concerned by the turbulence in financial markets and potential risks in the banking sector. They requested a review of the banks used by ISHS from Ernst & Young. Caution began being exercised by widening the number of banks used. Subsequent management of the bank accounts has been very sensible in a period of extreme volatility. The defensive investment portfolio is now showing reasonable returns as world markets have picked up. Since the Society has an international business changes in the value of the US dollar and the euro could have been very damaging had firm action not been taken to reduce exposure to exchange rate fluctuations. The Internal Auditors in their meetings with the Executive Director fully supported and applauded these approaches.

GOVERNANCE

Since the Board changes at regular intervals the Internal Auditors are keen to ensure that the legal responsibilities which are incumbent on new Board members are brought to the attention of all prospective candidates at an early stage in the election process. The Internal Auditors suggested that there should be a tangible continuation between the outgoing and incoming Boards in order to preserve accumulated knowledge and expertise. One way by which this could be achieved is by retaining on the new Board a retiring member who could offer mentoring guidance for a limited period (colloquially known as "grand-fathering"). Transference of accumulated knowledge and experience between outgoing and incoming Boards will aid efficient and effective management and in the longer term save the Society money and preserve the mid- to long-term goals of the Society.

STRATEGIC PLANNING

One important function for each Board is the formulation of its own strategic plan. This identifies the Board's aims and objectives for its tenure of office. There is now considerable accumulated experience for this task and significant guidance available from the Executive Director and his Team linking with a new Treasurer and the other Board members. Alignment between the continuing activities of the Society and future operations envisaged within a strategic plan is a subject for regular checking by the Treasurer in the first place and later by the Internal Auditors. As appreciations of worldwide risks emerge and change tactical objectives the Internal Auditors recommend that biennial reviews of each Board's strategic plans by Council should continue.

The strategic plan was originally conceived as being written for the entire 4-year period of tenure of a Board, but it is more appropriate for revisions to be made at shorter intervals. This process would be greatly aided, initially at least, by a mentor retained from the previous Board. Incoming Board's strategic plans should evaluate the Society's approach to new international associations with other societies and organizations. The Internal Auditors are keen that incoming Council members recognize the extent to which each new strategic plan might affect the net profitability of the Society and its staffing requirements. Concomitantly, travel and representational costs for both Board and Secretariat are likely to increase where new strategic goals are identified. Council is the ultimate arbiter in accepting new and revised strategic plans and should continue to be provided with business cases where there are likely to be substantial cost implications inherent in the objectives of a new Board. A strong tradition of review has been established by the current Board and it is very important that this continues. The Society by dint of the work of the current Board now has a world standing vastly greater than that which it held even a decade ago. It is very important that this standing is sustained and increased. Servicing the responsibilities stemming from that position however, has financial implications which should be made plain to Council.

INTELLECTUAL PROPERTY

Intellectual property belonging to the Society consists of names, titles and emblems. The Society has protected these by registration. Valuations should appear in each set of Accounts.

MEMBERSHIP

The past ten years has seen a significant rise in individual membership subscriptions to the Society. The Auditors note that there was a very creditable substantial increase after the Seoul Congress. As a result individual members are now the backbone of this Society. This does not reduce, however, the continuing importance of country memberships. Both are important aspects of the Society's constitution, and this is reflected in the composition of Council. Rising numbers of individual members increases the importance of the General Assembly meetings held during each Congress. The Society is continuously reviewing its activities and investing into initiatives aiming at the acquisition of new members with special emphasis to those from emerging and developing countries. The Auditors are, however, also conscious of the needs for evaluating the return on investment and efficiency relating to new member countries in these programmes of acquisition. The Internal Auditors have suggested that using the addresses received through the system for downloading ISHS publications could offer a low-cost means for gaining access to new and potentially new individual members.

PUBLISHING

There has been a substantial expansion of e-business and website activities on top of an expanding programme of hard-copy publishing. As a result the Society has become a major publishing house in its own right with a specialist niche market in all aspects of horticultural science and technology. The entire run of *Acta Horticulturae* is available electronically providing an additional asset and income stream. Additionally partnerships and collaboration with other horticultural journals are an increasing part of ISHS's business. Increasingly, these journals are digitizing their own back-runs so adding to the overall content and value of the Society's website. There is some risk inherent in publishing online material from third parties, and suitable guarantees should be obtained in advance of publication. The Internal Auditors

highlighted the excellent substantial quality of *Chronica Horticulturae* which over the past few years has been transformed into a publication of record and repute. Copy print and online sales to non-members are also welcome areas of business expansion.

MANAGEMENT

A key issue of good management practice in ISHS has been the staff control exerted by the Executive Director in consultation with the Board. Staffing is regulated by Belgian Law which closely reflects the Directives of the European Union (EU). These strongly protect the employment and pension rights of individual employees. By identifying new able staff for retention well in advance and enhancing staff efficiency relative to income the Executive Director has expertly minimized the Society's employment risks.

CONGRESSES AND SYMPOSIA

An important new initiative has been investment in an online article submission and review system. The Internal Auditors support the Board in their keenness that in future organizers of congresses and symposia make full and efficient use of this online publication system in order to shorten the time period for publishing new *Acta*. All commercial publishing houses now have their own standardized electronic systems and it is of the utmost importance that the Society and its associates follow suit. The *Acta Horticulturae* are important records of the proceedings of symposia and their usefulness is proportional to the speed of their publication.

The Auditors like the Board, are concerned about unforeseeable risks posed by congresses in view of the large loans which the Society makes as seed-corn funding in support of these vital events. The current Board has strictly separated Society and congress finances and it is most important that this wise practice is continued.

The Auditors request that in future all potential congress organizers produce fully-costed business plans indicating sources of funding and the financial break-even points at the time when bids are being made for hosting congresses. Each business plan should show evidence of having been audited by a reputable independent outside auditor. Separating the Society and congress finances limits exposure for the former. This sensible policy makes local organizers fully responsible for the financial success of their congress. Nonetheless, the Society should continue to be given the courtesy of substantial inclusion in the continuing budgeting and accounting processes. There are risks to the Society inherent in supporting congresses over an extended period (up to eight years) running-up to the event. Subsequently, because the Society is the publisher of *Acta* emanating from congresses there are post-event risks which need to be recognized and catered for by the congress organizers.

ACCOMMODATION

The new premises which the Society has recently occupied by courtesy of the Catholic University of Leuven are a considerable improvement on those used previously. They allow the Society to conduct its business more effectively and efficiently with improved value for money as a result of all operations being conducted from one address. There is currently very substantial unquantifiable benefit to the Society in its sound and convivial relationship with the Catholic University of Leuven. The Auditors feel that there might, however, at some future date be scope for the Society considering the purchase property for its own office accommodation. A change in policy here would require confidence that the Society could cope with the associated increased management and overhead costs.

CREDIT RISKS

The internal auditors note that the external auditors have currently indicated that there is no significant concentration of credit risk and there are no material liabilities within ISHS. Both statements are welcome indicators of the Society's financial probity as guided by its management.

Acknowledgement

It is with significant pleasure the Internal Auditors acknowledge the unstinting help and assistance which has come from the Executive Director and his Team allowing them to complete their audits speedily and comfortably. We also thank the Board for the skill and enthusiasm with which they have conducted the Society's affairs and for the courtesy with which they have received each of our reports. Their continuing hard work and endeavors have placed the Society in a strong and influential place in world horticultural affairs. This is only possible because of the financial care which they have exerted.

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Is Organic Horticulture Sustainable?

Michael Raviv

"Sustainability" is usually defined as a method of harvesting or using a resource so that it is not depleted or permanently damaged. This term also refers to endurance of natural ecosystems. Due to global population increase and the need to elevate the living standard of people in disadvantaged countries, an increase in productivity is sought, rather than a stable level of productivity. This actually dictates the need for sustainable development. Sustainable development describes the development of economic systems that last *indefinitely.* The Brundtland Commission (Anon, 1987) defined sustainable development as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* This definition thus argues for the rights of future generations to raw materials and vital ecosystem services to be taken into account by present decision-makers and, indeed, by the whole human society.

ORGANIC HORTICULTURE

The agri-food sector is vital to human welfare and health. It also contributes to the environment and to employment. Improving sustainability of the agri-food sector implies production of nutritionally-better food while using fewer external inputs and imposing less of an environmental burden. Sustainable agriculture would enable agricultural systems to be productive indefinitely, without exerting negative effects on the environment in general.

Organic agriculture (OA) is generally defined as a concept and a method of agricultural production that focuses on production without the use of synthetic pesticides, chemical fertilizers and the use of antibiotics or hormones in both plant and livestock production. It also eschews the use of genetically-modified organisms. Practitioners of OA endeavour to minimize the use of external inputs in general and to rely as much as possible on recycled inputs. Although OA is perceived by many people as a primitive "back to nature" trend, it is, in fact, an intricate process, based on sound scientific principles. Being a younger sector within agriculture, OA must close the knowledge gap created by a period of 170 years of extensive research devoted to conventional agriculture (CA) and conventional horticulture (CH). Many opponents of OA criticize it for its lower yields, compared with CA, while ignoring the impacts of this knowledge gap.

The Board of the International Federation of Organic Agriculture Movements (IFOAM) recently adopted a new formal definition of OA: *"Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."* (http://ifoam.org/growing_organic/definitions/doa/index.html)

OA production is governed by a strict charter, and is controlled by certifying organizations. The main goals of OA are environmental sustainability, economic efficiency and social responsibility. The demand for organic produce is driven by public concern over environmental quality and food safety. These consumers prefer organic produce, which they perceive as pesticide-free, nutritious and produced in an environmentally-sustainable manner. More scientific research is needed to validate or refute this perception.

The presumed environmental benefits of OA and organic horticulture (OH) range from erosion and runoff control, soil regeneration, pest, weed and disease control in plants in an environmentally-safe way and to the conservation of biodiversity. Organic horticulture is the part of OA that deals with fruit crops, vegetables and ornamental plants. Typically, OH is more intensive than OA in terms of both labour and external inputs. The global demand for organic products is estimated to be growing at a rate of ~15% per annum, with sales reaching $US39 billion in 2006. The biggest growth in consumption has occurred in developed countries such as the US and Europe.

HOW SUSTAINABLE IS ORGANIC HORTICULTURE?

Several attempts have been recently made to assess sustainability of OH, mostly at the on-farm level. The tested parameters have included

Compost site in an organic farm, Sde Eliyahu, Israel. Photo by Michael Raviv.

economical profitability; energy input/output and the use of non-renewable resources; maintaining and building soil fertility; avoidance of pollution; maintaining biodiversity and the social function of organic horticulture. In the present paper, the sustainability of OH will not be assessed per se, but it will rather be compared to that of CH. However, even if at a certain moment it appears that OH is more sustainable than CH, it must be understood that due to the dynamics of the systems, and, as new technologies are being adopted, our currently defined "integrated production" system may become conventional in a few more years. The subject of sustainability of OH was recently reviewed (Raviv, 2010).

Profitability and Resilience

In economics, an externality is an impact on any party not directly involved in an economic decision or activity. For example, manufacturing that causes air or ground-water pollution imposes costs on others now and in the future. In an ideal situation the polluter will have to compensate society for externalities, a process called internalization. Organic horticulturists are working within an open market, which shows little concern for the existence of externalities. Simple economic analyses of OA and OH are, therefore, unlikely to produce optimum outcomes with regard to the protection and enhancement of the natural environment. The basic economical profitability of several OH crops can be assessed, in terms of cost-benefit analysis, within these constraints. As these analyses do not incorporate ecological, social and cultural variables and services, they have limitations in comparing the sustainability of organic and conventional systems. Even so, and without ascribing any financial value to ecological benefits or financial costs to externalities, growing crops under organic conditions have shown in some cases to be similar or higher in profitability, compared with conventional practices.

A thorough literature-based comparison between 27 crop categories grown in different growing systems reveals that without price premia, crops such as potato, tomato and other vegetables grown in rotation are less profitable in OH, while fruit tree crops such as citrus are more profitable (Kaval, 2004). A general analysis of the effect of price premia reveals that across all 27 crops studied, OH-grown crops are more profitable than their conventionally-grown equivalents when a 20% premium was added. Additional recent profitability comparisons that were not reviewed by Kaval (2004) can be found in Table 1. In 7 out of 11 cases, OH-grown crops are more profitable than their conventional equivalents. These findings support the common feeling among professionals in the field, that the more intensive the crop, the more profitable is the organic production method. This may be attributed to the fact that in CH these crops are usually treated with more expensive synthetic inputs (pesticides and fertilizers) than field crops.

In economic terms, *resilience* reflects the capacity of the farm to survive various risks and market fluctuations and to adapt and respond to external impacts on the system. Although currently European organic farms show some resilience to economic fluctuations, it should be assumed that in the future organic price premia and organic area payments (fixed subsidy, paid in some European countries to organic farmers, based on the size of the cultivated area and the type of crop) will be phased out and it is doubtful whether under these conditions OH will maintain its current level of resilience. The situation is apparently different in countries such as USA, Australia and Israel, where, without any government subsidies, the organic sector is constantly growing.

A simple market-driven approach suggests that the size of the organic sectors should be determined by consumers' willingness to pay premium prices for organic products and not by direct or hidden subsidies for organic producers. Another approach that opposes the policy of subsidies or area payments, yet acknowledges the environmental benefit of OA, suggests a different policy: the introduction of a tax on pesticides and polluting fertilizers, intended to cover future cost incurred by these chemicals. As a consequence, in addition to lowering the pollution load on the environment, prices of agricultural commodities and of fresh produce will necessarily rise, which will make organic products relatively more attractive to consumers. The basic idea behind the "polluter-pays" principle is that in order to optimize resources use, those who engender costs – even external costs – should also foot the bill. The polluter-pays principle comprises three tiers: (1) In the narrowest sense, this principle means that the costs of measures to protect the environment are borne by the polluters and not by government. These include, for example, the costs of waste disposal or for constructing and operating wastewater treatment plants. (2) The second tier includes the costs of preventive and control measures e.g. repairs. (3) In the broader sense, the polluter-pays principle also takes into account consequential costs of as yet non-remediated environmental damages such as damage to soil fertility, buildings, roads or ground water. Implementation of the polluter-pays principle in its entirety is complicated, requires political will and was never tried until now. However, even if only the first tier is implemented, it would be positive for the organic sector. It's worth mentioning here that the same principle should be applied also to pollution generated by OH, such as persistent pesticides and leachates of organic fertilizers.

Energy Input/Output

One of the main aims of OH is to minimize the use of external inputs and especially the use of non-renewable resources such as fossil fuel.

Compost site, where organically-certified compost is produced. Photo by Michael Raviv.

Similarly to CH produce, OH produce requires considerable energy inputs for irrigation, machinery operation, transportation and refrigeration. Yet, a significant energy input in CH – synthetically-produced nitrogen – is avoided in OH. Corre et al. (2003) reviewed the literature about relative energy consumption and concluded that *"organic farming has higher energy use efficiency largely because mineral fertilizer nitrogen is not used."*

Most comparisons of energy use efficiency (EUE) among different cropping systems were conducted in the past on an area basis. The energy inputs per unit area required for organically-grown crops are typically 50% of those for conventional crops because of the lower fertilizer and pesticide input. It was correctly argued that due to lower yields frequently obtained in OH, area is not a valid basis for comparison and that comparisons must be made on a product basis. With advanced scientific knowledge and accumulated growers' experience, yields of organically-managed crops are closing the gap with those of CH (Pimentel et al., 2005), which further improves EUE under organic management. However, it should be mentioned that if composts of animal manures are used in CH as a source of N it can reach EUE levels similar or even superior to those of OH, simply because fertilizer N contribution to the total energy consumption of CH is so high. Another factor that should be taken into account here is that manures are bulky in nature and their transportation costs are high. It emphasizes the advantage of mixed cropping, frequently practiced in OH, where husbandry, field crops and horticulture are practiced in close vicinity.

Gündoğmuş (2006) recently analyzed the output/input ratio of apricot crops in Turkey. While the average apricot yields are somewhat (~9%) lower on organic farms, the energy output/input ratio is higher on the organic orchards, compared with the conventional ones (2.2 vs. 1.45, on average). Part of the improved energy efficiency in organic crops is offset by increased cultivation aimed at weed control. It

has been suggested for some time that much effort should be devoted to identifying ways to optimize energy-efficient weed control measures. It is also important to note that reduced cultivation has the added advantage of increasing carbon sequestration by soils.

Soil Fertility

Changing soil management from traditional farming systems based on crop rotations to intensive, often monoculture cropping systems has often resulted in a gradual decline in soil organic matter (SOM) and microbial activity and a deterioration of the stability of soil aggregates and resultant loss of topsoil (Carter, 2002). The main factors that drive these processes are extensive ploughing, leading to exposure and loss of organic matter, soil compaction by heavy traffic and the negative effect of fertilizers and pesticides on the soil's microbial activity (Fließbach et al., 2007) and microflora and fauna diversity (Wu et al., 2007). An extensive body of literature describes efficient methods to increase SOM, prevent erosion and restore soil fertility of over-utilized agricultural land (Grandy and Robertson, 2007; Milgroom et al., 2007). No-till or minimum tillage, amendment with various types of organic matter and minimizing the use of potentially-damaging chemicals, all matching the principles of OH, are the main methods that lead to restoration of soil productivity. Wherever possible, the use of mixed farming, crop rotation and/or the use of cover crops, again, common practices of OH and good CH, also contribute over time to potential soil fertility. As can be expected, the above recommendations can only be regarded as rough generalizations and individual site-, crop- and season-specific analysis must be carried out.

Soil Chemistry. Under CH conditions, typically all nutritional needs are met by timely application of nutrients. The efforts to maximize nutrient use efficiency are driven by the cost of the specific fertilizer and its effect on economic returns, and not by environmental considerations. In some countries (mainly in Europe) there are also regulations, intended to prevent nutrient loss by leaching or by gaseous emissions but this is not yet the situation in most other parts of the world.

In OH, where plants take up nutrients mainly through mineralization of SOM stimulated by soil microbes, the situation is more complex and poses several difficulties to the grower that must rely on a combination of both short- and long-term nutrient availabilities using different forms of organic matter (including plant biomass) and minerals, all having less-predictable release rates. From the point of view of the grower, the clearest indicator of soil sustainability is its capacity to provide plant nutrients, which is a quantitatively measurable parameter. In addition to this baseline level of soil nutrients, horticultural crops can be top-dressed with more available organic fertilizers such as guano or feather meal. However, unlike the case of soluble fertilizer application at times of high nutrient demand, it is difficult to ensure an accurate timing of nutrient release from these non-soluble fertilizers, so as to coincide with peaks of nutrient demand. In some cases, especially with high-value crops, this situation prompts the OH grower to use excessive amounts of fertilizers, increasing the risk of leaching surplus nutrients. Alternatively, growers can use some types of soluble organic fertilizers that can be applied through fertigation or as compost teas to facilitate plant nutrition. Unfortunately, all currently available organically-certified soluble organic fertilizers are quite expensive.

The key for both sustainable and horticulturally-efficient nutrient supply is a judicious combination of unsalable plant residues, symbiotic N_2 fixation by legumes, imported mineral and organic matter and enhancement of the activity of soil microorganisms that are able to release phosphorus, potassium and other nutrients by weathering of minerals from some soil types.

Wherever import of external inputs such as animal manure is not feasible, nutrients can be supplied based on biologically-fixed N_2 and green waste compost. Under these conditions, the risk of accumulation of undesirable levels of nutrients that can lead to non-source pollution is low. Fertility-building crops also provide other ecological services including improved soil structure, erosion protection and greater biological diversity (Jensen and Hauggaard-Nielsen, 2003). In some parts of the world (e.g. vegetable and fruit crops in New Zealand) this practice is common also in CH, but in most other parts of the world, this is not the case.

Nitrogen is usually considered the main yield-limiting nutrient for organically-grown crops. The dynamics of N mineralization are greatly affected by the type of organic matter added, soil type, temperature, soil moisture content and previous history of the soil, as reflected in its microbial population. Yet, it is common in OH that, due to excessive fertilization, N (and also P) can accumulate in the soil and reach excessive levels. Nitrate and phosphate leaching occurs when their amounts in the soil exceeds the crop's requirements and when water from rain, irrigation or snowmelt moves through the soil into the groundwater. Granstedt (2000) suggested that it is possible to conserve and minimize the losses of nitrogen and other plant nutrients through careful recycling within the agro-ecosystem, and through integration of crop and animal production. In comparing rotations containing processing tomatoes and maize under conventional and organic practices, Poudel et al. (2002) recorded similar yields of these crops in both systems, but lower potential risk of N leaching in the organic plots. Honisch et al. (2002) monitored nitrate leaching of a specific field during several years after its conversion to OA and found a consistent decrease in the leaching rate of nitrates, compared with the control plots. These results may

Medfly (*Ceratitis capitata*) trap. Photo by Neri Yitzhaki.

stem from the fact that organically-treated soils gradually become more stable suppliers of nitrogen with time, based on slow mineralization of SOM and active fixation (immobilization) of ionic forms of N into the soil biomass (Friedel and Gabel, 2001).

Soil Structure. Soil physical characteristics such as aggregate stability, oxygen diffusion rate, water holding capacity, infiltration rate and air-filled porosity greatly affect soil fertility. They affect plant water use efficiency (WUE) and nutrient uptake rate, the risk of crust formation and topsoil erosion. The pioneering work of Reganold et al. (1987) showed that, in the long term, organic farming systems are more effective than conventional counterparts in reducing soil erosion and in maintaining soil productivity. Since then, many other researchers have published similar results and proved, unequivocally, that OH has clear positive effects on soil physical characteristics. Parameters that typically respond to organic practice include a decline with time in bulk density and penetration resistance, improving ease of tillage, germination and root development. Among other factors, the abundance of earthworms, typical of organic soils, positively contribute to soil physical characteristics. As a result of the above-mentioned physical changes, organically-grown crops show higher resistance to drought stress and improved WUE (Colla et al., 2000).

Soil erosion causes major damage to agriculture (on-site) and to the environment (off-site). It is now well established that by conversion to OH, erosion can be avoided and, in fact, the process of topsoil formation eventually resumes (Milgroom et al., 2007). The main input affecting aggregate stability is fresh organic matter, through the effect of polysaccharides, glomalin (a glycoprotein produced by hyphae and spores of arbuscular mycorrhizal fungi in soil) and growing fungal hyphae. This is a short-term effect and in order to stabilize it, frequent inputs of fresh organic matter are required. Mature organic matter (such as compost, where most of the easily biodegradable material is

decomposed), has a less immediate but more long-lasting effect on aggregate stability, mainly based on the activity of humic acids. It was proposed that a combination of fresh and mature organic matter leads to optimal effect on aggregate stability (Annabi et al., 2007). In turn, stable aggregates may enhance physical protection of SOM against decomposition.

In many OH farms, tillage is used to control weeds instead of synthetic herbicides. This practice has a negative effect on aggregate stability. Alvarez et al. (2007) and others propose to address this problem by grazing.

Soil Biology. A healthy soil can be defined as a stable system with high levels of biological diversity and activity, resulting in efficient nutrient cycling and resistance to stresses. Perhaps the first and most important changes that accompany the conversion to OH are the increases in soil biomass and biodiversity. A distinction has to be made between SOM in the bulk soil and the labile pool of organic matter. The latter, also defined as particulate organic matter, has a more important role in increasing the activity of soil biota. It was demonstrated that long term organic management distinctly affects the labile, light fraction of SOM (Bending et al., 2004).

Different types of soil fauna and flora are affected differently by the change in soil management, according to their role in the food web. Protozoa, Archaea and bacteria take part in the initial processes of mineralizing organic matter. Therefore they are the first groups to be affected by addition of new organic matter. Later, other trophic groups, located higher in the food web such as predatory nematodes, mites, Collembola (springtails) and earthworms increase in number and activity. On the other hand, in many cases organically-managed soils host fewer plant pathogens than conventionally-managed soils. Examples are fungi such as *Phytophthora, Pythium, Fusarium* and others (Wu et al., 2007) and root lesion nematodes (Briar et al., 2007). This phenomenon is termed *pathogen suppression* and it refers to the ability of the soil biota to reduce or suppress pathogenic activity and limit the inoculum density of a pathogen. The development of suppressiveness against plant pathogens is relatively slow and takes several years to become apparent.

A somewhat different feature of many OA- and OH-managed soils is the *disease suppression.* Disease suppression refers to the capacity of a soil to limit disease development even though the host exists and the ambient conditions and the inoculum levels appear conducive. This type of soil resilience to biotic stress is also slow to develop, although high levels of application of suppressive compost can somewhat accelerate the process (Perez-Piqueres et al., 2006). At steady-state, organically-managed soils are in most cases more suppressive than conventionally-managed soils against a variety of soil-borne diseases (Liu et al., 2007). Both disease suppression and pathogen suppression are determined by microbial activity since their level is reduced by sterilization. Rhizosphere and root endophytic biota interfere with the pathogenic activity through mechanisms such as predation, hyperparasitism, secretion of antibiotics, competition for resources such as nutrients, carbon, iron (through siderophore formation) and space (niche exclusion) during the saprophytic stage of the pathogen's life cycle (Janvier et al., 2007). Two other mechanisms that are relevant to disease suppressiveness are *systemic acquired resistance* and *induced systemic resistance* (Zhang et al., 1998).

A striking characteristic of organically-managed soils is the abundance of mycorrhizal fungi, compared with conventionally-managed soils (Bending et al., 2004). This, however, is not the case when organically-managed soils are extensively tilled, as tillage exerts a negative effect on mycorrhiza. The association between plants and vesicular-arbuscular-mycorrhizal fungi has a major role in phosphorus and zinc acquisition. In addition, mycorrhitic crops are better protected against several soil-borne pathogens and can cope better with drought stress (Marjanovic et al., 2005).

Table 1. Comparison of the relative profitability of organic vs. conventional horticulture.

Crops tested	Profitability of organic plots	Reference
Apple	Lower	Groot, 2000
	Higher	Reganold et al., 2001
	Higher	Canavari et al., 2004
	Higher	Mon and Holland, 2005
Cherry	Higher	Olgun et al., 2006
Coffee	Similar[1]	Lyngbaek et al., 2001
	Lower	van der Vossen, 2005
Lettuce	Similar-higher	Ogbuchiekwe et al., 2004
Melon	Similar-higher	Ogbuchiekwe et al., 2004
Peach	Higher	Canavari et al., 2004
Pumpkin	Slightly lower	Brumfield, 2000
Spinach	Higher	Mazzoncini et al., 2000
Sweet corn	Slightly lower	Brumfield, 2000
Tomato	Slightly lower	Brumfield, 2000
	Higher	Mazzoncini et al., 2000
Vegetables	Higher	Colman, 2000

[1] Excluding certification cost

Greenhouse Gas Emission. The potential role of agriculture in carbon sequestration and mitigation of greenhouse gas (GHG) emission is debatable. Most of the carbon in agricultural fields is stored in the soil. Positive input of carbon to soil is determined by the net primary production and the fraction of it that remains within the soil and on the field. Loss of carbon is caused by decomposition and by loss of topsoil through erosion. The rate of decomposition is controlled by the soil's biological activity, as affected by ambient temperature, soil moisture content and soil physical and chemical conditions and by the nature of SOM. To determine the net greenhouse effect of agriculture, calculations of C sequestration in the soil, CO_2 emissions from the use of fossil energy and from breakdown of SOM and manures, CH_4 emissions from livestock and N_2O emissions from the soil have to be made. The results are usually converted into CO_2 equivalents. The cumulative results of such analyses suggest that carbon sequestration in soil has a limited and finite potential. However, most researchers concluded that by using appropriate measures, agriculture and especially OA and OH can sequester carbon rather than emit it, as is currently occurring, and can reduce methane and N_2O emissions to a considerable extent.

Foereid and Hogh-Jensen (2004) used a model (CENTURY element dynamics simulation model) to predict sequestration potential of OA under Danish conditions. They also tested the validity of the model predictions and were able to show a potential for an increase in SOM during the first 50 years after conversion to OA of about 10-40 g C m^{-2} y^{-1}, reaching a stable level after about 100 years. The use of grass-clovers in the rotation and as cover crops is particularly effective in increasing organic matter. It should be

Mulcher is used to shred old date leaves, to be used as mulch in date palm orchard. Photo by Neri Yitzhaki.

noted, of course, that this practice is standard also in CA in some countries. In addition to organic matter application, the main factors that contribute to SOM accumulation under arid and semi-arid conditions are the extent of tillage; the method of weed control (mowed vs. ploughed) and management of crop residues. Lal (2006) concluded that increasing crop yields in developing countries, most of them residing in the arid and semi-arid regions of the world, is possible using the above-mentioned soil restoration methods. He also noted that while advancing food security, this strategy would also off-set fossil fuel emissions at the rate of 0.5 Pg C y^{-1} through carbon sequestration in the agricultural soils of developing countries.

Maintaining Biodiversity

Evolutionary succession in ecosystems tends to progress towards increasing independence from environmental fluctuations (increasing autonomy of the systems). Agricultural ecosystems, on the other hand, have lost local autonomy due to the use of external inputs and technologies. Agriculture is an artificial ecosystem, characterized by relative genetic uniformity. Conventional agricultural systems require constant intervention, extensive external inputs (including some that carry environmental and human health hazards) and the use of non-renewable resources.

Biodiversity is the measure of the relative diversity among organisms present in a specific ecosystem. Enhanced biodiversity enables a host of ecological services such as pollination, pest control and maintenance of soil fertility, thus strengthening farm productivity. OH tries to replace the use of external inputs with reinforced local ecosystems' autonomy. As implied by the definition of OH, one of its aims is to maintain and enhance natural biodiversity both in the soil and above ground. For this purpose OH emphasizes, in addition to the avoidance of synthetic pesticides and fertilizers, the importance of minimum tillage, crop rotation, and building soil fertility using recycled organic matter. The strong emphasis on maintaining biodiversity stems from both purely moral and ecological considerations but also, in some cases, from economically-based plant protection and pollination considerations. The beneficial effect of OH on biodiversity was demonstrated by many authors and in relation to many types of organisms (Bengtsson et al., 2005). In some cases increased biodiversity in organic farms compensates for the lack of pesticide use but this is not always true (Scherber et al., 2006) and thus pest levels should be carefully monitored at all times. This means that translating the suggested advantage of increased biodiversity into the real-life situation of preventing commercially-unacceptable levels of plant damage is, in many cases, difficult. It is often concluded that the reduction in pesticide use on organic farms improves biodiversity but may increase pest damage. On the other hand, conventional growers are adopting more and more integrated production practices that are commercially viable while being relatively environmental friendly. Such practices, however, are not allowed in OH since they are based on careful use of synthetic pesticides.

Organic growers are using, in addition to imported biological control agents, mating disruption pheromones and traps, some organically-certified pesticides that may negatively affect biodiversity. A special case is the use of greenhouses and screen-houses where the opportunity to use inundative treatments of biological control agents enables a unique combination of low natural biodiversity and very low pest damage (Gerson and Weintraub, 2007). All these practices are now widely used also in CH.

Avoidance of Pollution

CA and CH may act as a source of environmental pollution to both air and soil environments. In some cases this pollution may reach the food we eat, but even if this flow of pollutants is averted, many of the polluting agents can still be found somewhere in the food chain and can unexpectedly cause damage such as loss of beneficial organisms in and above ground or eutrophication of streams and lakes far away from their application site. Overall, it is claimed that OH practitioners use less toxic pesticides. It is therefore expected that OH will emit fewer polluting agents into the environment. Still, some examples for potential polluting agents resulting from OH can be found such as surplus levels of phosphate that can accumulate in soil under heavy manure or compost applications. When plant nutrition is based on green manure and crop rotation, P levels can be balanced under organic management (Bengtsson et al., 2003). Another example of polluting agents resulting from OH are some of the organically-certified pesticides that are apparently unsustainable due to their long-term accumulation (e.g. copper).

Demand for organic food is driven, among other factors, by the fact that OA prohibits the use of synthetic pesticides. Only a few pesticides are approved for organic use (e.g. elemental sulphur, copper fungicides, natural pyrethroids) and growers are advised to use them only as a last resort. Consumers' assumption that organic food is practically pesticide-free leads to the belief that it is healthier than conventional products. Consumers of organic product are therefore willing to pay more for organically-grown food. To ensure this, wide margins around organic fields are required. An even better approach is a regional conversion to OA. Other measures include long conversion periods and a rigorous inspection procedure to prevent fraud.

The Social Function of Organic Horticulture

The formal definition of OA states that it: *"combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."* This definition underlines the humanitarian aspect of OA and OH. OA is not only meant to preserve nature, the soil and our food; it also intends to improve our livelihood and this refers to farmers, workers and consumers alike.

In a society where individualism is common for most people, OH greatly benefits from cooper-

Dates wrapped with net for protection. Photo by Neri Yitzhaki.

ation among farmers and between farmers and consumers. Many organic farmers try to forge a societal connectedness around a locally-responsive food system, as opposed to the regular view of food as an anonymous commodity. Institutions such as community-supported agriculture, producer-consumer cooperatives, farmers' markets and community land trusts are examples of this approach. It should be mentioned that the fair-trade concept, the tendency to minimize food-miles and preferring locally-grown food complement the organic concept. Nonetheless, in many situations, organic produce is shipped overseas to the same distances as CH produce as the grower seeks the highest net returns.

In terms of social impacts, OH aims at helping to secure land tenure, contributes to rural employment and helps keep small farms in business by supporting a community's self reliance and encouraging social participation. How are these highly idealistic intentions manifested in daily life? This question is especially relevant nowadays, when the organic sector has grown and is starting to become part of the mainstream. Large-scale conventional growers that have entered into organic production also sell in local marketing venues. Several researchers tested the hypothesis that the small scale idealistic farmers are distinctly different from the relatively larger recently-established operations. Their findings did not support this hypothesis and showed that most organic farms, including large new operations, apply diverse, mixed farming practices and also market directly to local consumers (Lockie and Halpin, 2005).

The role of the organic sector in contributing to rural employment is of special importance. OH requires more labor – thus providing better employment opportunities in rural areas and helping to moderate the urbanization trend.

It is clear that the individual farmer is the one who determines whether the social function of the farm is of any importance beyond official regulations. Certification bodies can test pesticide residues in produce but cannot test how much the farmer cares for employees. This gap has yet to be bridged by institutions such as IFOAM. This and other socially-related issues are unresolved and are rapidly evolving, in both developed and developing countries and it remains to be seen what direction they will take. The changes happening in developing countries are of special interest and importance. For example, Pretty (2007) analyzed some of these trends and suggested that there is a major role for sustainable agriculture in the road to securing a better livelihood in such countries. Among other factors he emphasized that: *"Diversity of crops is good for family diet and for pest control, while helping in year-round marketing."* And: *"Adding value to commodities through home industries leads to receiving a higher proportion of the final price paid by consumers."*

Organic banana, fertilized with compost. Photo by Michael Raviv.

KNOWLEDGE GAPS AND REQUIRED FUTURE RESEARCH

Combining low inputs with environmentally-sound technologies clearly requires that OH farmers have better knowledge of the management strategies used in the agroecosystem than farmers who employ conventional methods. To achieve this aim, an aggressive research policy is essential, supported by dedicated advisory and education systems. In general terms, the required scientific work should lead to improved yields with lower amounts and costs of inputs. In order to do so, there is a need to identify the limitations in current production methods of OH and to develop accessible measures and parameters for comparing the sustainability levels of different agricultural and horticultural practices.

One of the major as yet unsolved problems of OH is weed control. The main weed control measure currently employed by organic growers is tillage. It is now well documented that tillage negatively affects aggregate stability, leading to increased erosion; it lowers mycorrhitic activity; reduces soil suppressiveness against soil-borne diseases and reduces biodiversity of soil biota, especially earthworms. In addition to the above, tillage has a negative effect on overall C sequestration efficiency, which is lower than in a no-till system (Grandy and Robertson, 2007). Although there are some other weed control measures such as flaming and a few phytotoxic compounds that are organically-certified, there is only fragmentary information about their efficiency, economic viability and side-effects. Hence the most important field of research in OH should be the identification of novel and efficient methods for weed control that have no negative effects on sustainability.

Another critical research subject deals with plant protection against pests and diseases, which negatively affects yields in OH. Some of the organically-certified pesticides are only partially effective while some others are, to some extent, polluting and apparently unsustainable due to their long-term accumulation (e.g. copper). Better and more sustainable plant protection measures are therefore crucial for OH sustainability. OH is severely constrained in humid regions compared with less humid environments due to increased disease pressure (Granatstein, 2004).

Organic nutrients in OH typically represent 25-30% of the total variable costs of production. This cost fraction is much higher than the corresponding values in CH and it calls for intensive research aimed at improving nutrient use efficiency and identifying cheaper sources of nutrients. The main barrier to improved nutrient use efficiency is the timing or synchronization problem. Green manures, animal manure and composts are usually applied once a year. The initial, most extensive stage of mineralization is not necessarily coincident with the time of peak demand for nutrients and root activity. Unused nutrients may then leach below the root zone. In addition to the need for more research pertaining to organic fertilizers, and because organically-certified nitrogen sources are expensive, more research is needed to determine the most appropriate cultivars and application methods involving green manure crops.

Another issue related to compost and manures is their variable, irreproducible characteristics. An important line of research should, therefore, aim at understanding how the type of feedstock, process parameters and properties of the end-product affect the physical, biological and nutritional performance of organic materials.

A fourth line of required research is plant breeding. Currently, organic farmers largely depend on cultivars supplied by conventional plant breeders, on heirloom cultivars or on local races. Conventional cultivars, and to a lesser extent, heirloom cultivars and local races were developed for farming systems in which artificial fertilizers and agro-chemicals are widely used. The organic farming system differs fundamentally in soil fertility, weed, pest and disease management, and poses higher demands on product quality and yield stability than conventional farming. For further optimization of organic product quality and yield stability, new cultivars are required that are adapted to organic farming conditions.

CONCLUSIONS

The assumption that OH is a more sustainable form of horticulture than CH is demonstrated by its lower use of external inputs, more resource recycling, minimal use of potential pollutants, higher biodiversity and system resilience and higher social responsibility. One of the clearest indicators for the higher level of sustainability of OH is its greater potential to sequester carbon and, thus, to mitigate the accumulation of GHG in the atmosphere. It can be concluded that given the fact that OA and OH provide a range of environmental and economic services; organic management offers a "win-win" strategy towards improved sustainability and should be implemented as part of a general and integrated sustainability policy. Some questions remain: How sustainable is OH and how can it be more sustainable in the future? Closing the knowledge gaps mentioned above can help answering these questions.

One of the main objections to a wider implementation of OA and OH is the uncertainty about their capacity to meet the food needs of the growing world's population, and especially the less-developed countries and less-affluent consumers. This claim is based on the fact that for many years, yields of organically-managed crops were (and still are in some cases) lower than their conventional counterparts (Connor, 2008). As a result, more land has to be cultivated in order to obtain a similar amount of food, resulting in more damage to landscape and wildlife habitat. It appears, however, that some of these claims are exaggerated. Badgley et al. (2007) determined that organic methods could produce enough food per capita to sustain the current human population, and potentially an even larger population, without increasing the agricultural land base. It is too early to conclude which of these two contrasting positions is more accurate. However, there is a continuing trend of yield increase in OH and there is no reason to believe that given enough research efforts and extension work, the yield gap cannot be closed to the extent it exists. This is definitely the case with several major horticultural crops, where more experience has been gained over the years in crops such as avocado, citrus, potato, and stone fruits. Similar results continue to accumulate in other cases as well (Reganold et al., 2001).

There are good reasons to believe that in areas that suffer from water shortage and are prone to desertification, OH will be able to better cope with water stress. This is a result of the higher water holding capacity of soil amended with organic matter (Colla et al., 2000) and of higher mycorrhizal activity in organically-managed soils (Marjanovic et al., 2005). Projected adverse effects on agriculture from global climate change could also be mitigated by OH.

Barriers to wider adoption of OH such as the disappearance of mixed farming in modern agriculture still exist. Since OH can greatly benefit from mixed farming, the solution might be to form collaborations among arable, horticultural and animal farms. Other barriers are of a more fundamental nature and they pertain to the current regulations and rules that dictate the way OH is performed. Two characteristic examples are described below.

In Europe and in some other parts of the world OH can be performed only in soil (except for the production of transplants). On the other hand, in North America (see National Organic Program) and Oceania, some certification bodies allow organic vegetables to be grown in substrates and in hydroponics. It can be argued that restricting OH to soil is the luxury of regions of the world where fertile soil is available. In many parts of the world this is not the case and many people believe that growing organic crops in containers should be possible. It should be noted that effluents of containerized plants can be recycled, thus reducing the risks of nutrient leakage, and significantly increasing both water- and nutrient- use efficiencies (Raviv and Lieth, 2008). Naturally, there is a lack of solid information on many aspects of organic soilless production and much more research is required, especially in the area of liquid organic fertilizers.

The second example is related to the ban on use of composted municipal solid waste (CMSW). In the past CMSW was frequently polluted with heavy metals and other polluting agents. With current improved technologies and enforcement measures on source separation, the quality of CMSW has improved considerably and can be improved even further based on market demand. On the other hand, it is becoming clear that as the OA and OH sector increases, availability of organic matter that is required for building soil fertility and supply nutrients might become a limiting factor. Since the origin of all urban organic matter is agricultural activity it becomes imperative to allow farmers to close the circle and return this organic matter back to the soil. By addressing these two imposed limitations, OA and OH may become more productive and more relevant to the current needs of the society.

Organic peach orchard, grown under insect-proof net. Photo by Neri Yitzhaki.

It must be clearly understood that both OH and CH are dynamically-evolving systems so that any comparison of the environmental benefits from either of these systems may change over time. With stricter environmental regulations imposed on all types of agriculture, the relative benefit of OH might decrease. The introduction of new technologies such as genetically-modified organisms may also change the picture over time. A constant monitoring of the relative sustainability levels should continue in order to address this issue.

Within the context of these dynamic changes, OH can continue to serve as a model for a more environmentally-friendly system. Its example can influence CH to a great extent and make it more sustainable. In fact, some technologies that were mainly developed for the needs of OH are now widely used by conventional growers. Examples are the use of many biological control agents, solarization as a substitute for methyl bromide, and the use of insect-proof nets to protect greenhouses and even orchards. Keeping such a role model active and developing it further through research will undoubtedly continue to contribute to the quality of our environment even if OH continues to be only a small fraction of the horticultural industry.

It should be stated that all the above-mentioned beneficial effects of the organic system on soil fertility can be accomplished in conventional systems without organic certification, and at a lower cost due to the avoided certification cost. These environmental services can be combined with a judicious use of minimal amount of fertilizers, some benign, highly selective pesticides and carefully-tested genetically-modified crops. The result may be a growing system even more sustainable than the current OH.

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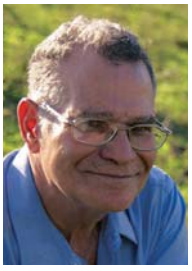

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Cassava: Global Production and Market Trends

Dario Salvatore Caccamisi

Cassava (*Manihot esculenta*) is a major global commodity (Table 1) being the key food staple for an estimated 500-1,000 million people across the World, particularly in developing countries (Semino, 2003; Velásquez and Giraldo, 2005; Ceballos, 2006). On average, the primary use is for human food in Africa, cattle feed in Europe, and a number of industrial uses, with Asia playing a key role in several industrial markets, including starch.

The development of a viable cassava market in developing countries demands a reliable supply of low cost cassava roots, and a viable relationship between suppliers and processors. However, cassava farmers are in a weak price-taker position in comparison to buyers. Vertical integration, the development of contractual links between farmers and industrial processors of agricultural commodities, is largely missing for cassava. The building of this link is central to the successful development of the cassava economy at a global level.

Development of niche markets, adoption of different price formation schemes, higher elasticity in consumer response to price variations and adjustment of the cassava sector to the growth of substitution products are some of the expected trends generated by innovation in products and distribution. These latter trends will offer cassava producers new market opportunities resulting from higher marketing efforts. In a market-oriented cassava sector, investments in research tools for cassava consumer science are required if adequate knowledge of consumers' purchasing patterns and quality requirements wants to be attained and transferred to primary producers and processors. A wide program of cassava consumer research is necessary if the cassava food sector is to keep abreast of the changing market conditions and the opportunities posed by the new market trends at a global level.

Traditional cassava planting in West-Africa.

GENERAL OUTLOOK

World production of cassava grew significantly over the last decade, and now averages over 210 million tonnes (Mt) per year (FAOSTAT Database, 2010). Africa contributes over 50% to the global production of cassava roots, followed by Asia (30%) and South America (15%). The largest world producer is Nigeria, where 40 million farmers produce 20% of the world production (UNIDO, 2006). One-third of the African population gets more than half of their daily calories from foods made from cassava roots (Murray, 2004). Approximately 70% of the global production of cassava roots is used for human consumption. The remaining 30% is used for animal feed and industrial processing.

In the global supply of food, cassava follows cereals (maize, rice and wheat) and potato. In Africa, the contribution of cassava to food supplies of population is much higher than in Latin America, where the local population does not depend on a single carbohydrate staple as the backbone of its diet (Lynam, 1989). In Africa cassava is used as a food crop and as an income crop. In rural areas large sectors of the population eat and depend on a cassava meal at least once a day (Anon., 2007). Cassava performs five duties of an income product: famine reserve, rural food staple, cash crop for urban consumption, industrial raw materials, and foreign exchange earner (Sanni et al., 2004). Cassava is now used by more African farmers and on a larger crop area than fallowing. Cassava is fast becoming a potential engine of

Table 1. Average annual world production of cassava and major food commodities (1999-2008). Source: Author's calculations on FAOSTAT Database figures, 2010.

Commodity	Production (Mt)		Trend (%)
	1999-2003	2004-2008	
World			
Cassava	180	217	+20.4
Potato	313	320	+2.3
Yam	40	49	+20.3
Cereals, total	2,074	2,332	+12.4
Africa			
Cassava	97	114	+16.6
Potato	13	17	+29.6
Yam	39	47	+20.6
Cereals, total	118	142	+20.1
Asia			
Cassava	51	67	+31.2
Potato	120	130	+8.8
Yam	0	0	n.s.
Cereals, total	1,002	1,114	+11.4
South America			
Cassava	30	34	+15.3
Potato	13	13	+3.3
Yam	0	0	n.s.
Cereals, total	109	129	+17.9

Fresh cassava roots ready for peeling.

growth in many developing countries and exerting a powerful influence on world trade, courtesy of efforts of governments and the private sector in developing unique, value-added, cassava-based products for human consumption and industrial purposes (FAO and IFAD, 2000).

Cassava is the most important crop in the farming systems of several African regions as a food crop and cash income source. Cassava for food consumption is processed into several forms, the most common being gari (cassava flakes). Some of its by-products can be used as starch while the bark is often fed to livestock. Its production has expanded tremendously in the past decade, but post-harvest problems seriously constrain development (Nwajiuba and Akinsanmi, 2003; Cock, 1984; Mariscal, 1984; Rickard, 1982; Booth, 1976). On average, the primary use is for human food in Africa, cattle feed in Europe and a number of industrial uses worldwide, with Asia playing a key role in several industrial markets, such as starch. In Latin America only about 35% to 40% of production goes towards food consumption whereas 10% of production is lost to post harvest deterioration. About 50% to 55% goes towards animal feed and trade. In Asia 40% of the crop produced goes towards food consumption, whilst the rest is either waste, animal feed or starch production for export or local use (Murray, 2004; Lynam, 1989). The overall consumption of starch at a global level was about 48.5 Mt in 2005, with a significant +21.5% rise from 2001 to 2005 and an estimation of overall 70 Mt consumption in 2010. Cassava accounts for 7.5% of the overall production of starch, following other commodities such as sweet potato, grain, potatoes and sweet corn that alone stand at 70% of the global production of starch (Giannini, 2006).

At a global level, Africa shows faster growth in both cassava production and harvested area compared to Asia and South America. Western Africa is leading this trend (Table 2).

Asia shows the highest improvement of cassava yields (Table 3). On average South America yields are higher than African (Fermont et al., 2008).

Exports of cassava products are limited (Table 4 and 5), not exceeding 3% of global production, at an overall average value of US$583 million annually. In Africa, cassava products are almost totally consumed domestically. Only Asia significantly contributes to international trade of dried cassava, with Thailand and Vietnam the leading countries and China receiving 70% of global imports. Although the volumes are limited, Belgium and The Netherlands play a role in attracting imports of dried cassava products and re-exporting them to end-consumer countries.

Additional contribution to global exports of cassava products is coming from cassava starch, a commodity whose importance at a global level is constantly on the rise. World export of cassava starch amounted to 1.4 million Mt per year in the period 2003-2007 (FAOSTAT Database figures, 2010) increasing up to US$318 million per year sales value. Also in this case, Asia only is contributing to international exports of cassava starch, with Thailand covering over 85% of global exports of this commodity (1.3 Mt, FAOSTAT Database figures, 2010). For more details on the trends in exports of cassava starch at a global level see the impressive growth of the international trade of this commodity (Table 5).

International trade of cassava roots is very limited because of the post-harvest physiological deterioration, a disorder that involves the separation of the roots from the plant (Rickard, 1985). Coating roots with paraffin wax, often along with a fungicide, extends crop life about two months longer.

Table 2. World Production Index of cassava from 1989 to 2008 (1989-1993 Index = 100). Source: Author's calculations on FAOSTAT Database figures, 2010.

Country	World Production Index		
	1994-1998 Yearly average	1999-2003 Yearly average	2004-2008 Yearly average
Angola	151	308	510
Brazil	92	96	111
China	109	117	126
Congo	91	82	79
Ghana	145	192	206
India	112	115	146
Indonesia	94	103	121
Mozambique	124	155	159
Nigeria	130	137	176
Paraguay	96	124	161
Tanzania	84	67	81
Thailand	82	86	110
Uganda	74	160	157
Vietnam	88	138	307
Africa	113	129	150
Eastern Africa	96	124	134
Western Africa	132	150	183
Americas	95	103	119
South America	94	102	118
Asia	92	99	130
Oceania	111	110	129
World	102	114	138

Table 3. Average annual yields of cassava orchards (t/ha) from 1989 to 2008. Source: Author's calculations on FAOSTAT Database figures, 2010.

Continent	1989-1993	1994-1998	1999-2003	2004-2008
Africa	8.0	8.3	8.8	9.6
Eastern Africa	6.9	6.5	7.7	8.5
Western Africa	9.7	10.3	9.9	11.0
Americas	11.6	11.7	12.5	12.8
South America	12.2	12.3	13.2	13.4
Asia	13.2	13.2	14.9	18.2
World	9.9	9.9	10.6	11.8

TRENDS IN CONSUMPTION OF CASSAVA PRODUCTS

In Africa there is a significant domestic demand for industrial cassava products and the region has the resources to produce and process cassava. However, in Nigeria, the world's largest producer, the quantity of cassava cultivated primarily by smallholders is inefficient and subsistence oriented rather than market driven. The conse-

Table 4. Average annual exports of dried cassava products (t) from 1988 to 2007. Source: Author's calculations on FAOSTAT Database figures, 2010.

Country/continent	Exports (t)				Share (%)
	1988-1992	1993-1997	1998-2002	2003-2007	
Belgium-Luxembourg	43,308	120,224	164,327	129,738	2.4
Costa Rica	19,244	42,428	60,800	81,127	1.5
Indonesia	1,047,028	547,800	180,947	165,526	3.0
Netherlands	424,371	267,346	139,225	63,245	1.2
Thailand	7,850,032	4,527,765	3,690,800	4,100,025	75.5
Vietnam	28,752	65,017	172,367	854,587	15.7
Africa	28,037	15,144	785	6,514	0.1
Americas	28,472	48,386	66,433	101,775	1.9
South America	3,802	2,339	3,784	15,093	0.3
Asia	9,231,691	5,196,486	4,046,497	5,123,134	94.3
Europe	501,484	442,477	311,543	196,895	3.6
Oceania	758	1,124	1,596	2,400	0.0
World	9,790,441	5,703,617	4,426,855	5,430,717	100.0

Modern flash-dryer equipment in cassava processing plants in Lagos, Nigeria.

quence is inconsistent and costly supply of raw materials. In turn, insufficient supply means the processing industries have to interrupt production, which results in their operating below their capacity and at high costs. In other areas of the world, particularly in Asia and Latin America an efficient and competitive cassava value chain has been developed (UNIDO, 2006). One of the lessons learned from Thailand and Brazil is the importance of a reliable supply of raw materials (fresh roots and / or chips).

A recommended approach that has contributed to reliable supply of raw materials in other sectors is called vertical integration (UNIDO, 2006), the development of contractual links between primary producers (farmers) and industrial cassava processors. Vertical integration is based on a long-term mutually advantageous relationship where the processors not only guarantee a minimum price to the farmers but also provide a series of services, including technical services. In return farmers commit to delivering all, or a significant portion of their production to the processor (Moreno et al., 1988). In several producing countries, this link is still largely missing, but the building of this link is central to the successful development of the cassava economy both as local food and for industrial uses or for export (Nwajiuba, 1995; Nwajiuba and Akinsanmi, 2003).

A rather sensitive subject is whether, and under which conditions, cassava products may become food for the poor. Some authors would suggest that gari will not be a subsistence food if field production and processing systems are not improved (Meludu et al., 2001). In our opinion, this might be possible provided the improved technology significantly reduces production costs. On the other hand, international experiences in Africa and Latin America (Mozambique, Nigeria, Colombia) demonstrate a good potential for cassava food expansion

Table 5. Average World Export Index of cassava starch (1988-1992 Index = 100). Source: Author's calculations on FAOSTAT Database figures, 2010.

Continent	World Export Index		
	1993-1997	1998-2002	2003-2007
Americas	326	565	957
South America	379	559	1008
Asia	195	291	549
Europe	443	410	1113
World	198	295	557

pulled by the growth of modern retail outlets and the development of innovative food products. The objection that diverting cassava roots from basic food to the production of high-value food products would lead to an increase in cas-

The author with some retailers and Agricultural Development Programme technicians at the open market Ile-Epo in Lagos, Nigeria.

Traditional cassava processing in Ogun State, Nigeria.

Rice and cassava gari at the open market Ile-Epo in Lagos, Nigeria.

sava prices, therefore making this commodity less affordable for the poor, is not consistent with recent statistics from FAO (FAOSTAT Database figures, 2010). The UN food agency estimated that the potential additional land area available for cultivation in sub-Saharan Africa amounts to more than 700 million hectares (FAO, 2009) while the global cassava harvested area is 18.4 million hectares. Thus, if market price rose, farmers would find land enough to expand production that in the medium term will contribute to both price reduction and market balance.

Cassava is traditionally consumed in a wide variety of forms in Africa (Dorosh, 1989). New cassava products such as instant fufu (cassava paste) and pre-packed gari developed for supermarkets are on the rise in the urban areas, bringing more attention to product quality (Ezedinma and Nkang, 2008; FAO, 2007). Our observations on the expected market trends of some cassava food products in Lagos, Nigeria show good market potentials for instant fufu and pre-packed gari in association with the development of modern market channels, like supermarkets: a trend that may be observed worldwide. Whilst the rural population is still tied to a cassava diet, younger generations in urban areas of Africa are progressively replacing cassava foods with other food products, particularly rice (Lo Bianco, 2009; FAO, 2007). Indeed, rice, the world's most abundant food and the favorite staple of billions of people worldwide, is becoming more and more popular in the region and progressively replacing cassava products also in the Africa population diet (Onyeche, 2008). In Asia most people who eat cassava use it as a substitute for rice, due to lack of finances or shortage (Murray, 2004).

Development of niche markets, adoption of different price formation schemes, and higher elasticity in consumer response to price variations are some of the expected trends generated by both the expansion of innovative products and the adjustment of the cassava sector to the growth of substitution products. These trends will offer new market opportunities with more diligent marketing efforts (Lynam, 1989) but these changes will not succeed if not supported by adequate marketing strategies. A network of institutes, universities and private enterprises should implement joint-research activities in the field of cassava consumer science preferably under the co-ordination of international organisations such as the International Institute of Tropical Agriculture (IITA) and the International Center for Tropical Agriculture (CIAT).

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Horticultural Hues: Natural Dyes from Plants

Karen Diadick Casselman and Sara J. Kadolph

While there is no precise date for the earliest human production of color in Europe, Asia, or the Americas, fragments of textiles and pottery shards demonstrate that a wide range of materials were used (Adrosko, 1971; Barber, 1991; Cardon, 2007). These included minerals, bodily fluids, and animals which provided dyes and pigments of purple, black, ochre, red, and yellow (Cardon, 2007). Native groups harvested whatever was abundant, including leaves, bark, roots, lichens, berries, soot, and soil (Grae, 1974; Cardon, 2007). Wherever immigrants travelled, regardless of geography and climate, the newcomers observed native dyers at work and thereby expanded their own repertoire of colors (Whitehead, 1982). Colonists and settlers discovered that indigenous dyers used native and introduced flora including flowers, weeds, ferns, lichens, and also the leaves, roots, and bark of common trees and shrubs. This botanical abundance was augmented with various types of excess vegetable material (Grae, 1974; Krochmal and Krochmal, 1974). Notable in this latter category are the outer skins of onions (*Allium* spp.), and also pulp and residue leftover from making beer, juice, vinegar, and wine. Mushrooms unfit for consumption were a popular dyestuff, as were lichens which fell naturally from trees, and nuts where their abundance permitted harvest for both food and color (Casselman, 1993). Flora and herbaceous plants, combined with what was readily available from forest and field, and a measure of ingenuity, were used by homemakers, amplified when required by purchased dyestuffs including cochineal, indigo, and madder (Adrosko, 1971). Dye additives, or "mordants," were improvised or purchased (Owens, 1888; Grieve, 1931). There are many links between self-acquired information on dyeing, horticulture, and medicinal botany (Cardon, 2007; Chenciner, 2000; Diadick Casselman, 2009; Thirsk, 1997). These influences have converged over time to create the foundation for contemporary natural dye practices. Research on natural dyes today is an academic field with reference to natural history, material culture, botany, agriculture, chemistry, science education, fine art, and horticulture.

They shall make those sacral vestments for your brother Aaron and his sons, for priestly service to Me; they therefore shall receive the gold, the blue, purple, and crimson yarns and the fine linen.

Exodus 27:20, 5

HISTORIC NATURAL DYES

Murex

The ancient purple dye, murex, used in many regions of the world is obtained from various molluscs including *Hexaplex, Nucella*, and *Thais* (Cardon, 2007; Diadick Casselman and Terada, 2010). Described historically as "Tyrian Purple," murex was the basis of the Phoenician economy. Later murex was adopted by the Romans and "wearing the purple" became synonymous with status and rank. Murex workshops, existing for several centuries before the rise of Rome, and hundreds of years thereafter, have been excavated as far apart as Tunisia and 8th century Ireland. Thousands of shells are required to produce a small amount of dye which is extracted from a miniscule hypobranchial sac contained in the animal. The popularity of murex was due to its beauty and the connotation of luxury since the dye was as valuable as gold. It was possible for ancient dyers to combine murex with lichen dyes to produce hundreds of specific shades of reddish-blue, blue-purple, violet, dark blue, and also blue-black.

Orchil

Many genera of lichens have been used as a purple dye since the Phoenician period when they were utilized as an economic and ecological response to diminishing supplies of molluscs (Diadick Casselman, 2010; Diadick Casselman and Terrada, 2010). The name for the purple dye of lichen (*Roccella* spp.) in the ancient world was "orchil" but there were vernacular equivalents in 8th century Ireland and even in 13th century Greenland (Diadick Casselman, 2001, 2010). Some of the most significant medieval church vestments (chasubles) contain traces of orchil (Hofenk de Graaff, 2004). In the 19th century Millicent Sutherland and William Lauder Lindsay, a Scottish psychiatrist and botanist, promoted lichen dye research and production as a response to highland poverty (Diadick Casselman, 2008, 2009). Harris tweed production brought lichen dyes into the 20th century but their use today is primarily in homeopathic medicines and the cosmetic industry.

Seventeenth century Dutch tablecloth features madder (*Rubia tinctoria*), indigo (*Indigofera*), and orchil (*Roccella* spp.).

Dyers who require lichens generally rely on horticulturists as pruned branches of fruit trees are often laded with unwanted lichen growth. Another environmentally-acceptable harvesting method is to collect from the forest floor after a winter storm (Diadick Casselman, 2010). Botanists have an innovative procedure for "seeding" lichens in the arctic (Phillips, 2009).

Logwood

A purple dye can be obtained from the heartwood of *Haematoxylon campechianum*, known as logwood, a tropical tree of the Caribbean. Curiously, logwood was more economically important as a source of black dye achieved by treating logwood "chips" with an iron mordant (Dean, 1999; Hofenk de Graaff, 2004; Cardon, 2007). Due to the need for sombre clothing during the English Reformation, and the role of black clothing and hats that accompanied the spread of Puritanism, logwood was played an economic and cultural role similar from that of sugar (Cardon, 2007).

(Left) the mollusk *Murex trapa* that produces the ancient purple dye murex; (Right) the Emperor Justinian the Great (483–565) with his purple cape denoting royalty.

Indigo

The blue dye called indigo can also be derived from various plants, including woad (*Isastis tinctoria*), dyer's knotweed (*Polygonum tinctorum*), and species of *Indigofera*. Woad, a species of the Brassicaceae, becomes extremely weedy, and thus occasionally banned (Thirsk, 1997; Cardon, 2007). It is currently enjoying a revival among artisanal dyers in Canada, Norway, and France who appreciate woad's ability to thrive in cool climates and with little water (Kadolph and Gilbertson, 2002; Cardon, 2007). During the Roman period in ancient Britain, Celts demonstrated their resistance by tattooing their face and body parts with woad (Carr, 2005). In Ireland 6th and 7th century records reveal that dried woad plants, prepared leaves (ready for dyeing), and also woad fields, were awarded to women as part of a divorce settlement (Kelly, 1998). Woad cultivation was widespread throughout medieval Europe because the blue created was well-suited to use with madder, for cheaper purples, and it was also used to dye fabric a black color (Cardon, 2007; Hofenk de Graaff, 2004). A cultural "war" broke out in 17th century France when imported indigo threatened to supplant indigenous woad which had become synonymous with military uniforms, popular apparel, cosmetic eye paint, and even as a pigment applied to furniture (Pastureau, 2001). Woad remains a form of value-added horticulture today for cotton fabrics, paper, and cosmetics (Cardon, 2007).

Leaves of *Indigofera tinctoria* contain a blue pigment known as natural indigo which cannot be dissolved in water (Liles, 1990; Cannon and Cannon, 1994; Dean, 1999; Cardon, 2007). Indigo is now one of the most familiar dyes worldwide thanks to the universal appeal of denim. Although indigo can be applied to all fibers, including wool and silk, it is similar to madder (see below) in that cotton has a particular affinity for this particular blue dye. Indigo has been fundamental to trade from Asia westward (Barber, 1991; Cardon, 2007). Indigo blues possessed symbolic importance in various cultures and also as an artist's pigment. There were attempts to grow indigo in the American south where the proximity of cotton horticulture suggested it as a likely economic pairing (Liles, 1990). At present there is a relative shortage of "genuine" indigo which is more expensive than the synthetic product now widely available, one which has replaced the authentic blues dye used in mass-produced clothing (Kadolph, 2010).

Madder

The herb madder (*Rubia tinctoria*) produces an ancient red dye that was less expensive than cochineal. Used in many cultures up to the 18th century, and into the 20th century in India, and elsewhere in Asia, madder is the source of the famous "Turkey Red" dye which came to the cultural centers of the west along with tea, coffee, spices and silks (Thirsk, 1997; Chenciner, 2000). Madder requires mordants to produce Turkey Red on cotton or silk, but the dye also yields orange-reds and similar shades on wool or linen (Liles, 1990; Dean, 1999; Cardon, 2007). Agricultural records from the 16th to the 18th century in England show the popularity of madder as an agricultural crop among "gentlemen farmers" (Thirsk, 1997; Chenciner, 2000). In Flanders, Holland, and throughout Eastern Europe madder fields were as familiar and successful as grain (Chenciner, 2000). Madder was also widely used in the early 20th century in cosmetics and as a food dye.

Cochineal

Cochineal is one of the most expensive European dyestuffs of the post-Renaissance period (Hofenk de Graaff, 2004; Cardon, 2007). Spanish conquistadors noticed the brilliant scarlets produced by this scale insect (*Dactylopius coccus*) which occurs on *Opuntia* cacti in Mexico and Central and South America. One adult weighs approximately 40 mg which renders the dye obtained from the crushed body both precious and unique (Cardon, 2007). There were many attempts to introduce the insect and the cacti it feeds upon, to Britain, Europe, and Asia. Today cochineal is a lucrative form of value-added horticulture in Mexico where cacti plantations are "seeded" with

(Left) lichen (*Roccella* spp.); (Right) handwoven wool blanket by K.D. Casselman using a lichen dye (Courtesy of the Smithsonian Institute, Washington, DC).

(Left) Logwood (*Haematoxylon campechianum*), a legume used to produce the black dyes haematoxyon widely used as a histochemical dye; (Right) haematoxyon-dyed silk scarf by S.J. Kadolph.

insects. A range of colors can be obtained with mordants (see Table 1) including pink, rose, scarlet, and orange-red; when over-dyed with indigo or woad, the red becomes purple (Hofenk de Graaff, 2004).

Saffron

This yellow dye from the saffron crocus (*Crocus sativus*) has been cultivated for centuries for producing color in fabrics and food, and for medicine (Cannon and Cannon, 1994; Thirsk, 1997). At its height of popularity in the 17th and 18th centuries, the demand for saffron offered lucrative opportunities in horticulture. The wealth created by saffron is evident in the culture of the market town Saffron Walden in Essex (Thirsk, 1997); saffron emblems are present in the town's coat of arms, the seal, and present as embellishments in churches and houses (Thirsk, 1997). Saffron value was increased as it was thought to be a cure for smallpox, and so used throughout India. It was produced in plantations in 17th century Virginia and is now widely used as a food colorant for such dishes as saffron rice.

***Indigofera tinctoria*, the source of indigo.**

Alizarin

This yellow dye popular among east coast tribal cultures in Canada and the United States is produced from ladies' bedstraw (*Galium tinctorum*), a spreading perennial plant. The yellow flowers yield yellow dyes while the dried roots produce shades described as coral, apricot, or salmon (Liles, 1990; Cannon and Cannon, 1994; Dean, 1999). Bedstraw was used in the colonial period to stuff mattresses due to the fragrance of dried flowers, stems, and leaves. While never an important economic commodity, in Scotland, bedstraw acquired a unique medicinal role as a treatment for "ladies' complaints" (Diadick Casselman, 2009). Bedstraw roots were also used in the highlands for unusual olive greens, in tartans, obtained with an iron mordant (Cannon and Cannon, 1994).

CRAFT DYEING

Throughout the world, conferences and workshops demonstrate a high level of interest in craft dyeing (Kadolph and Gilbertson, 2002; UNESCO, 2006). Contemporary dyers are also diverse, and include writers, artists, and designers, historians, professors, scientists, and farmers. They grow dyestuffs, sell seeds, design naturally-dyed fashions, and pursue art and craft dyeing on a wide range of materials including paper, textiles, and even wood (Kadolph and Gilbertson, 2002; UNESCO, 2006). Dyers have blended old applications with new information and an environmental awareness which removes the risk to native and ornamental flora (Dean, 1999; Diadick Casselman, 2010). The idea that natural dyes have little value today has been replaced by a model which encompasses alternative agriculture, sustainability, and opportunities in value-added horticulture (Thirsk, 1997). One-of-a-kind pigments and dyes comprise a category of micro-economic activity with implications for cultural tourism, marketing by means of the internet, and promotional opportunities similar to the "buy local" and organic food campaigns (Kadolph and Diadick Casselman, 2004; Kadolph and Gilbertson, 2002; Ommer and Turner, 2004).

There are three categories of natural dyes: substantive, self-mordant, and adjective (Dean, 1999; Casselman, 1993; Kadolph and Diadick Casselman, 2004; Liles, 1990; Nieto-Galan, 2001). Substantive dyes are able to form chemical bonds with the polymer of the fiber without the addition of any chemical. Onion skins (*Allium* spp.) and all lichen dyes are in this category. Self-mordant dyes such as tree barks do not require mordanting since they include a mordant within their natural structure in the form of tannins. Adjective or additive dyes, by comparison, must have a mordant added to the dye bath to assure that the dyes will form a chemical bond with the polymer of the fiber and withstand exposure to such potential environmental hazards to dye loss as sunlight and machine washing.

Standard Immersion Dyeing (SID)

Procedures for SID are as follows:

1. Gather sufficient dyestuff (plant material) to fill a bucket or pail. Chop or shred if bulky. To facilitate pigment extraction, press the dyestuff down and add sufficient cold water

Ladies' bedstraw (*Galium tinctorum*), the source of alizarin.

(Left) collection of cochineal insects (*Dactylopius coccus*) from cactus in Mexico; (Right) Redcoats of the British Military were based on cochineal, detail from *The Death of General Wolfe* by Benjamin West, 1770.

to cover. Use a rock or a heavy plate to keep the mass immersed. Set aside 24 hours. If local water is contaminated with minerals such as iron, a substantial color shift may occur. Iron is a common mordant used by dyers. If local water is not pure, distilled or deionized water can be used to avoid the color shift.

2. In a small kettle or pot (one never used again for cooking), bring the dyestuff and soaking water to a boil (98–100°C.) (Some dyestuffs are heat sensitive and require a lower temperature for extracting the dye from the dyestuff. The heat sensitive dyes are often found in flowers. A temperature of 70–80°C is usually effective for extracting the dye from flowers.) Maintain the temperature over heat for 1–2 hours depending upon the bulk of the dyestuff and the time needed to render it completely limp. (There will be some evidence of color in the "dye liquor" by this time). Once done, set the pot and contents aside.
3. When the pot and liquid are cool to the touch, strain the cooked dyestuff through a colander or sieve which is never again used for cooking. Allow the wet dyestuff to drip for several hours. Forcing the dyestuff against the colander or sieve will remove additional liquid from the dyestuff. Save all of the liquid as this constitutes the "dye bath" (Casselman, 1993).
4. While the dyestuff drains, soak a skein (or hank) of white wool, or a silk scarf "blank" (purchased from a craft or art supply store) or other item to be dyed, in warm water.
5. Next, return the saved dye bath or dye liquor to the (cleaned) kettle or pot and add the textile. Raise the heat to a slow simmer (90–92°C) (or 70–80°C for the heat sensitive floral dyes). Maintain this temperature for 15 minutes, then reduce to 60°C and process another 45 minutes. Remove the pot and cool the contents to room temperature.
6. Remove the textile. Drain or squeeze out remaining dye liquor. Shake, then hang to dry in the shade.

Mordants

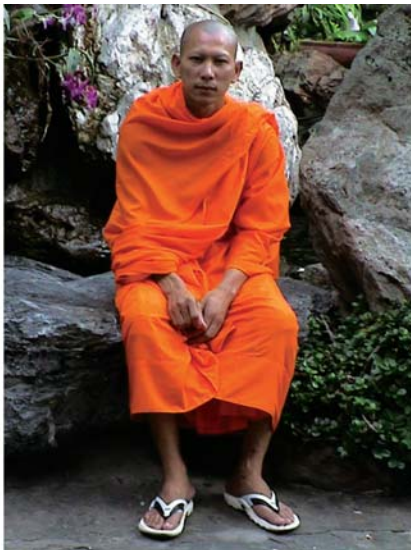
Mordants (Table 1) are metallic salts which present "sites" on fiber where chelation, the formation of a molecular bond, can occur (Cardon, 2007). Derived from the Latin *mordare* (to bite), mordants are a necessary ingredient in all adjective dye baths where they enable an irreversible chemical reaction between dye and fiber (Liles, 1990; Cannon and Cannon, 1994). Mordants also help prevent fading and expand the range of colors which can be obtained from a single plant. Mordanting can be achieved by natural dyers as follows:

1. Choose a mordant from Table 1. Dissolve the powdered mordant in 250 ml hot water. If minerals are present in the water, use distilled or deionized water or the mineral in the water, especially iron, will also bond with the textile. Add the mixture to the dye bath, and stir until it is evenly distributed. Add the wet (soaking) textile. Using an implement reserved only for dyeing, stir until the textile "swims freely."
2. Raise the temperature of the dye bath (as in SID). Maintain heat for 10 minutes, then reduce the heat and process an additional 45 minutes.
3. Remove mordanted textile, cool, and allow to dry.
4. Once the textile has dried, rinse by immersing in clear water. If color appears to "bleed out," continue rinsing in fresh, cool water until the run-off water is clear. If minerals are present in the water, use distilled or deionized water for this step.

Table 1. Common mordants used by natural dyers.

Common name	Chemical name	Amount to use	Typical results
Alum	Aluminum potassium sulphate	10 g alum to 400 g dry wool or silk	Creates yellows
Copper	Copper sulphate	$^1/_2$ alum amount	Creates greens
Iron	Ferrous sulphate	$^1/_2$ alum amount	Darkens most colors
Tin	Stannous chloride	$^1/_2$ alum amount	Brightens most colors

(Left) Autumn crocus (*Crocus sativus*), source of saffron; (Right) saffron robe of a Buddhist monk.



There are several options as to when to apply a mordant: these variations are known as pre-mordanting, simultaneous mordanting, and post-mordanting. When dyeing and mordanting are carried out at the same time, omitting the 4 steps above and adding the mordant to the dyebath comprises "simultaneous mordanting" and dyeing, all in one step. In pre-mordanting, the 4-step mordant bath described above precedes dyeing. Post-mordanting involves immersing the already-dyed fibre in a mordant bath, and processing it a second time (Liles, 1990). Post-mordanting is done to achieve a broader palette of colors from a single dyestuff. There are also recipes for replicating 18th and 19th century mordants. These colonial treatments involve soaking scrap iron or copper in vinegar (or urine) to produce dark shades. For dyers who want to avoid chemical mordant baths, however, there are numerous effective alternatives which can be disposed of safely (Kadolph and Diadick Casselman, 2004; Diadick Casselman, 2001).

New methods in natural dyeing highlight creativity rather than a systematic approach. These techniques are not dependant on recipes, so the dyer is free to improvise. Guided by ingenuity and intuition, the interpretive dyer finds unusual sources of dye in the garden. Slugs soaked in ammonia yield a pink, and houseflies, cutworms, and other non-beneficial insects, yield various golds and browns when applied directly to fabric using a mallet (Diadick Casselman, 2000). Variations are endless. Rather than cook the dyestuff (as in SID), moldy fruit such as berries can be used. Materials left over from making jam yield excellent dyestuffs. Material to be dyed can be placed in a zip lock bag, the dyestuff added, and placed in a freezer (Kadolph and Diadick Casselman, 2004). The bag is removed for sufficient time to allow some thawing to occur once or twice a day, and returned to the freezer for a week or longer. Two factors come into play with random dye methods. Dyed garments may fade slightly with these processing methods. To withstand laundering, clothing can be processed after dyeing in a microwave oven, or a rice steamer, to set the dye. Extra heat may improve dye fastness by forcing dye deeper into the interior of the fibers.

(Left) wool tapestry dyed with osage, weld, fustic, marigolds, cochineal, madder, and indigo. Courtesy Pamela Feldman; (Right) wool skeins dyed by K.D. Casselman. The strong yellows are from goldenrod (*Solidago canadensis*), the rose and pink colors are from a lichen (*Umbilicaria mammulata*), the grey dye was obtained from the leaves of common blackberry (*Rubus* spp.) with an iron mordant.

***Rubia tinctorum*, the source of madder.**

Alternatives to the standard chemical mordants listed in Table 1 include everything from rusty nails and horseshoes to Epsom salts, baking soda, pickling alum, tea, all types of vinegar, as well as leftover wine (Kadolph and Diadick Casselman, 2004). Dyes can be overripe berries, tea, foliage or twigs of colorful plants such as species of *Acacia, Berberis, Morinda, Rhus, Prunus* or *Quercus*, herbaceous plants such as species of *Aster, Galium*, or *Solidago*, and various weeds. Liquids can be added "as is"; dry ingredients are dissolved first in boiling water. These techniques blur the distinction between "dyestuff" and "mordant", which is intentional. Tea is a case in point. As with many beverages, tea, a self-mordanting dye, creates interesting effects due to the presence of tannins.

How, and when to use kitchen and garden additives, is entirely up to the dyer. The suggestions provided in this discussion are a guide to encourage personal investigation. One Norwegian dyer has dubbed these "Stunt Dyes" because the goal is to experiment as you enjoy nature's bounty and make use of plant material that might otherwise be wasted or in the case of weedy species, destroyed.

Sustainability

Natural dyeing was at one time an activity not without criticism. There were questions about mordants, and fears that dyers would pillage plants (Diadick Casselman, 2001). As a response, dyers began to assume responsibility for their work. At dye conferences in many countries both presenters, and the audience, now include a wide range of amateur and professional gardeners, professors of art and natural history, mycologists and lichenologists, anthropologists, historians, farmers, chemists, mathematicians, archaeologists, and entrepreneurs. Interest has spread internationally with current research projects crossing disciplinary boundaries. Fine artists use natural dyes as pigments for work on paper and even on parchment (Kadolph and Gilbertson, 2002). Sarah Dalziel, a British Columbia student, has become a specialist in the growing of woad (*Isatis* spp.) and her projects have won national science awards. The focus today is on ethical aspects of using organic materials, ecology, horticulture, and on sustainable and innovative ways to build an audience for the study and a market for the products so creatively produced. Sustainability is key to responsible natural dye practise. Co-operation with horticulturists can help to assure that dyers make sound choices.

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AUSTRALIA, NEW ZEALAND, AND PACIFIC ISLAND REPRESENTATIVES MEET DOWN UNDER TO DISCUSS THE 29TH INTERNATIONAL HORTICULTURAL CONGRESS

In February 2010 the Executive team met to develop the program for the forthcoming 29th International Horticultural Congress, which is to be hosted in Brisbane, Australia over the 17-24th August 2014 by the Australian Society of Horticultural Science and the New Zealand Institute of Agricultural and Horticultural Science. The team, drawn from Australian, New Zealand and Pacific Island representatives, will be present at Lisbon, Portugal to promote IHC2014 with the theme "Horticulture – sustaining lives, livelihoods and landscapes". The team will be pursuing excellence in securing knowledgeable and experienced key note speakers, providing rewarding pre and post Congress tours and comfortable and reasonably priced accommodation. How many cities do you know that can offer you and accompanying persons a whole range of different horticultural experiences, as well as whales, historic buildings, dolphins, crocodiles, wine tasting, 4WD safaris, dingoes and beaches?

Meet the Executive and the IHC2014 ambassadors at the promotional booth in the exhibition area. They will be wearing golden wattle coloured shirts.

If you want any early information contact Dr. Russ Stephenson, Australia, on Russ.Stephenson@deedi.qld.gov.au or Jill Stanley, New Zealand on JStanley@hortresearch.co.nz

Executive team members: back row (left to right) Nick McLeod, Gerald Mcevilly, Peter Oppenheim, Richard Markham; front row (left to right) David Aldous, Russ Stephenson, Rod Drew, Ian Warrington, Jill Stanley (absent John Chapman).

Fruit Production and Research in Russia

Yu.V. Trunov, A.V. Nikitin and V.A. Solopov

Russia has extensive natural resources for successful development of fruit production. Climatic conditions of the Southern region and the southern part of Central and Volga region are considered to be the most favorable for the efficient production of fruit and berries and most commercial orchards are concentrated there. In 2008, there were 533,100 ha of orchards and berry plantations in the Central federal region (42.7%), Southern region (39.6%), and Volga region (11.9%). The Southern federal region has the leading position in production with 767,800 tonnes (t) (32.5% of the gross yield in the Russian Federation) followed by the Central (554,000 t) and Volga (514,200 t) region. However, present fruit consumption is only about 47 kg per capita/year, of which 27 kg are imported fruits. Therefore there is a deficiency of trace elements and biologically active substances in the diet of a considerable part of the population. Climatic conditions and labor resources in the country indicate that Russia should be able to produce satisfactory quantities of domestic-grown fresh fruits for its population. Clearly, the potential of Russian horticulture will only come to fruition with close cooperation between state, science, and commercial growers.

Map of Russia.

RUSSIAN POMOLOGY

In Russia, only 178,000 ha are commercial orchards (1/3), while home gardens and dachas occupying 355,000 ha produce about 2 million t of fruit, mainly for domestic consumption. The technologies in the noncommercial orchards do not provide high yields. In commercial farms, outdated orchards established in the former specialized state farms still prevail. Lack of proper management has resulted in unsatisfactory phytosanitary conditions, high rate of tree decline, and very low yields (about 4 t/ha), and agronomic and biological resources of many of these orchards are poor.

Economic reforms in Russia have resulted in considerable changes in commercial fruit production marked by a reduction of total area both in regions with unfavorable and optimum climatic conditions in the Southern and Central federal regions. This has resulted in a 40 to 60% reduction in enterprises producing fruit and berries. Due to the nature of modern fruit production technology (high capital intensity, long-term period of orchard cultivation, complexity of orchard maintenance) tree fruit production has been considered less attractive for investments compared with other branches of agriculture that have a shorter period of payback. Therefore many former state fruit farms are presently growing grains and other less capital intensive crops.

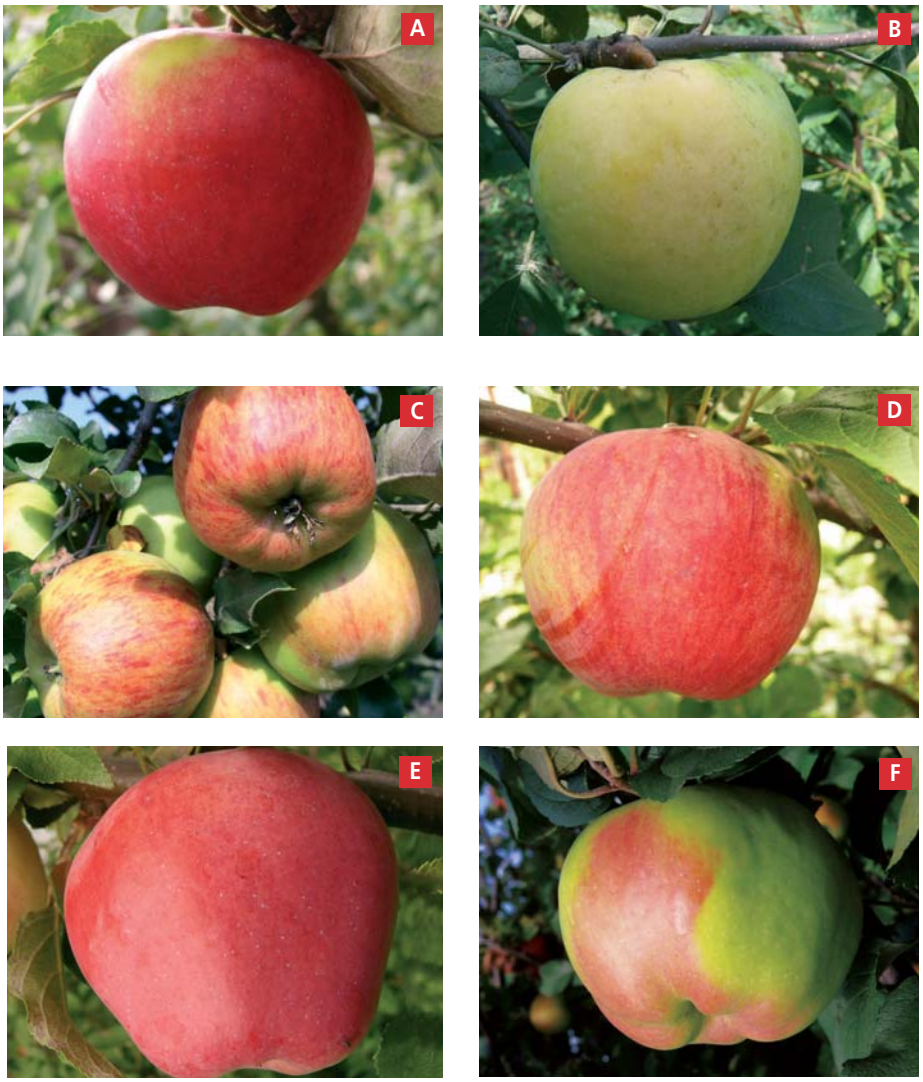
In contrast to many developed countries of Europe, Asia, and the Americas, the major part of Russian territory is characterized by extreme climatic factors such as low winter temperatures, lack of warm temperatures during the growing season, and variable precipitation. Only in a few southern regions climatic conditions are similar to those in countries with a developed pomology. During the last decades, the ecological situation in Russia is characterized by destabilization due to a considerable increase of adverse factors. These include a worsening of the ecological environment as a whole caused by anthropogenic pollution, an increase of water and temperature stresses during the growing season, and increases of both common and new pests and diseases.

APPLE PRODUCTION

Apple is the major fruit crop of Russia. Apple orchards are mostly located in the Central federal region (more than 100,000 ha), principally in Voronezh and Lipetzk. Stone fruits are cultivated on much less area and its production is mainly concentrated in Southern federal region. The dynamics of apple yield in Russia is quite unstable and commonly there is no crop or very low yields every third year. Annual fruit yields fluctuations can show a 3-5-fold variation. Fruit quality is poor. Only 30% of all harvested fruit meet official quality requirements to meet extra or first grade.

Due to increasing demand for fruits, marketable fruit production is gradually rising. Despite the decreasing area under cultivation, total Russian fruit production has remained unchanged (2.4 million t) with average yield increasing by 40%. In commercial orchards, gross fruit yield per hectare has increased by 15-20% and crop production increased 2-fold. There are many examples of large progressive horticultural enterprises in Russia. "Sad-Gigant", situated in the Southern region, has efficiently introduced advanced practices and produces 40-50 thousand t of high quality fruits annually with long term storage capacity of 35 thousand t and maintains processing facilities. In Central Russia "Agronom" and "15 let Oktyabrya" in the Central region, producing 25-30 thousand t annually of high quality fruits with production reaching 20-30 t/ha. Other largest fruit producers from Central region are following: "Central Chernozem Fruit and Berry Company" with annual fruit production of 15-20 thousand t as well as "Novonadezhdinskoe" and "Dubovoe" with 5-10 thousand t annualy.

There are positive trends in new orchard plantings. Due to removal of old non-productive or declining orchards, the total area of perennial fruit plantings continues to wane. However, in the largest specialized fruit farms situated in territories with the most favorable climate conditions for fruit growing the area of newly planted intensive orchards has significantly increased. In some farms, new annual plantings of 50-200



Popular apple cultivars in Russia: A. 'Venyaminovskoye', B. 'Antonovka', C. 'Dekabrenok', D. 'Bessemyanka Michurinskaya', E. 'Kandil Orlovskiy', F. 'Bogatir'.

ha have occurred as a result of government subsidies.

In these new fruit plantings, the preference is given to intensive production. Trees on dwarf clonal rootstocks increased productivity and fruit quality and allow a reduction of labor and resource expenses. At present, 5% of orchards in Russia are of the intensive type using clonal rootstocks. The greatest area under such orchards is in the Northern Caucasus (15%) in the Southern region. There are now three types of commercial apple orchards in the Central zone of Russia: extensive orchard on vigorous rootstocks, semi-intensive orchard on semi-vigorous and semi-dwarf rootstocks, and intensive orchard on dwarf rootstocks.

Extensive Orchards on Vigorous Rootstocks

These old-fashioned orchards are widely dispersed in old commercial plantations in the Central zone of fruit growing of Russia and although unpromising are still being planted in some farms. Seedlings of disease resistant apple ('Antonovka Obiknovenaya', 'Grushovka Moskovskaya', 'Korichnoe Polosatoe') are used as apple rootstocks. Some of these orchards are characterized by low precocity (start to bear only 5th-6th year after planting), low average yield (10-20 t/ha), low crop marketability (no more than 40-50%), and with costs covered only in the 11th-13th year after planting. Productive orchard life is expected for 35-40 years, but there are some blocks planted in 1931-1932. Most orchards on vigorous rootstocks are spaced at 7-8 x 4-6 m and trained as a central leader system or as globular forms with a number of leaders.

The management system can be partially intensified by maintaining a tree height of 3.5-4 m, using precocious and productive scion cultivars, and regular tree pruning. This system is expected in 20% of orchards where topsoil is severely depleted or of low fertility, and with areas of low average moisture and an absence of irrigation. The assumption is made that there will be sufficient processing facilities available and that adapted cultivars may have poor performance in intensive orchards.

Intensive Orchards on Semi-Vigorous and Semi-Dwarf Rootstocks

This system is proliferating in commercial orchards in the Central zone of fruit growing. The trees are grafted on clonally rooted semi-dwarf and semi-vigorous rootstocks (e.g. B.396, B.118, B.545) or with using interstems of dwarf rootstocks grafted on seedlings of winterhardy cultivars. This type of orchard is characterized by high precocity (bearing 3 to 5 years after planting), high fruit yields (20-30 t/ha), good marketability (up to 50-70%), costs covered in the 7th-8th year after planting, and an expected orchard life of 22-25 years. In these orchards spacing is 5-7 x 2-4 m and trees are trained as a central leader system with different number of tiers or the bush-system. Intensification is widely used in these orchards (tree height maintenance, corridors formation for light inside the canopy, detailed pruning, and training adapted to particular cultivars). In the near future, this type of orchard will prevail in the Central zone of Russia (up to 50-80% of total area under newly planting orchards) because of its costs saving and low inputs.

Intensive Orchard on Dwarf Rootstocks

This is the most promising type of orchard and is receiving interest by the leading fruit growers in Russia. Frost-resistant clonal, own-rooted dwarf rootstocks (B.396, B.146, B.491) are recommended for the Central zone of fruit growing. These orchards are highly precocious (bearing in the 2nd to 3rd year after planting), have high yield (30-50 t/ha), high crop marketability (up to 80-90%), costs covered in the 5th-6th year after planting, with an expected orchard life of 12-18 years. Trees are spaced 3-4.5 x 0.5-2 m and trained to a slender spindle. The main advantages of such orchards are as follows: slender canopies are easy to handle, prune, and harvest; high precocity; larger yields due to higher tree density; and rapid cost covering. The disadvantages of orchards on dwarf rootstocks in Russia are severe wood and root breakage necessitating the need for support; shallow root

Budagovsky 9 rootstock.

Rootstocks nursery.

Extensive orchard on seedling rootstocks fruiting.

systems, which requires additional irrigation, nutrition supply, management, and rapid response to climate impacts; short life-span of trees; and high cost of establishment.

HORTICULTURE PROGRESS IN RUSSIA

Continuous high level of fundamental and applied research provides a solution for the main problems of horticulture. At present horticulture in Russian Federation is at a qualitatively new stage of development where highly efficient marketable agricultural enterprises are now providing the domestic market with high quality fruit and berries based on modern horticultural science and technology.

The Russian government is providing support to the fruit growing enterprises. The main measures of state regulation of horticulture are: (1) state system of healthy and high quality plant production in major local nurseries and regional scientific centers; (2) orchard planting subsidies for healthy planting material; (3) domestic market protection measures by increasing state taxation or quotas; and (4) no-interest credit and insurance systems for fruit production. Close cooperation between state, science and commercial growers will be required to achieve the full potential of Russian horticulture.

THE I.V. MICHURIN ALL RUSSIAN RESEARCH INSTITUTE AND MICHURINSK STATE AGRICULTURAL UNIVERSITY

The development of horticultural science in Russia is closely connected with the name of I.V. Michurin (1855-1935), outstanding horticulturist and breeder. He was the first Russian to attempt to combine the efforts of breeders, agronomists, economists and engineers for successful horticultural development in Russia. He initiated the foundation of the first Institute for Horticulture, the I.V. Michurin Research Institute for Horticulture, subordinated to the Russian Academy of Agricultural Sciences and located in Michurinsk, Tambov region, Central Russia.

Researchers in All-Russia Michurin Research Institute for Horticulture developed more than 100 cultivars of horticultural crops. Among them there are 17 cultivars of apple; 1 pear; 7 sour Tamaris (sour cherry); Rozovyi zhemchug, Rondo (sweet cherry); Russkyi, Russkyi Zhyoltyi, Malakhit, Slivovyi, Chernomor, Chernoslivovyi (gooseberry); Viksne (red currant); and Bagira, Zelyonaya Dymka, Sozvezdie, Chyornyi zhemchug, Tat'yanin den' (black currant). Scientists in All-Russia Michurin Research Institute for Horticulture developed the technology of winter-hardy lily propagation.

The present Institute consists of 8 scientific departments including 11 laboratories, an Engineering Centre, and an experimental fruit storage facility. Present projects include technology of apple and pear clonal micropropagation; technology of pear production and long-term storage; technology of black currant production; orchard fertilization and weed control; plant protection against pests and diseases in the field and in storage; pest- and disease-free strawberry transplant production; systems of fruit storage and transportation in air; controlled atmosphere, and modified atmosphere following post-harvest treatments with ethylene inhibitors; and pre- and post-harvest mechanization.

Another organization in Michurinsk is Michurinsk State Agricultural University - one of

Intensive orchard on semi-vigorous and semi-dwarf rootstocks.

Intensive orchard on dwarf rootstocks.

I.V. Michurin All Russian Research Institute.

Michurinsk State Agricultural University.

the oldest Russian agricultural institutions of higher education. It has become well-known due to its unique scientific research in the sphere of horticulture, as well as due to the training of qualified agricultural professionals. The Michurinsk State Agricultural University was formerly a Lawn-and-Garden Institute organized on the initiative of Ivan V. Michurin in 1931. In 1934 it was renamed Fruit-and-Vegetable Growing Institute, and in 1999 the institute was given the status of a university.

In addition to the research program, the Michurinsk State Agricultural University offers courses of professional training in 7 branches of agricultural science, leading to the Bachelor's or Master's degree, and 20 courses of higher professional training leading to the degree of a specialist. It provides 38 trade programs, 27 refresher courses, and 6 professional retraining programs for agricultural specialists. In May 2009, Alexander V. Nikitin, born in 1976, was elected rector of the university, the youngest rector in the history of the university.

Ivan V. Michurin (1855-1935).

The University today has 6000 students and includes 5 institutes and 4 departments. It provides 4 doctoral programs, 21 postgraduate courses, involving 150 post-graduate students and employees, 400 teaching staff members including 3 academicians of the Russian Academy of Agricultural Sciences, 50 professors and Doctors of Sciences, and 235 associate professors.

Scientific research projects are carried out at the university in accordance with the national program "Agro-Industrial Complex Development," and the "Program of Fundamental and Priority Applied Researches in the Agro-Industrial Complex." The university prepares scientific projects on a contractual basis from enterprises and institutions. There are 8 main branches of science in the focus of the university researchers' attention: agriculture, economics, engineering, biology, chemistry, teachers' training, philology, sociology.

Both the university and All-Russia Michurin Research Institute for Horticulture occupy a leading position in intensive fruit growing in Russia based on breeding efforts of scion cultivars and rootstocks. Seventeen apple rootstocks have been included in the Public Register including Budagovsky's Paradizka, Budagovsky's Malysh, 57-491, 62-396, 67-5(32), 71-3-150, 62-223, 57-490, 57-366, 57-476, 57-257, 60-160, 60-164, 57-233, 71-3-150, 54-118, 58-238. Rootstocks created at the Michurinsk State Agricultural University, successfully compete in the international market. They are widely used in the selection process and analyzed in France, Canada, the Netherlands and Poland. The university cooperates with its scientific partners, such as "SNK - Elaris" (France), "Botden and Van Willigen" (the Netherlands), "Varieties International" (USA), in the fields of introduction and testing of rootstocks. The scientific progam of the University and the All-Russia Michurin Research Institute for Horticulture has helped making Michurinsk as the leading scientific agricultural centre of the Russian Federation.

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New Books, Websites

BOOK REVIEWS

Following Pistachio Footprints (*Pistacia vera* L.) – Cultivation and Culture, Folklore and History, Traditions and Uses. Sulle Orme del Pistacchio (*Pistacia vera* L.) – Coltura e Cultura, Folclore e Storia, Tradizioni e Usi. Damiano Avanzato and Ignazio Vassallo (eds.). 2008. *Scripta Horticulturae* 7. International Society for Horticultural Science. 116p. ISBN 978-90-6605-541-4. € 30. Available from the ISHS Secretariat (www.ishs.org/pub/scripta.htm).

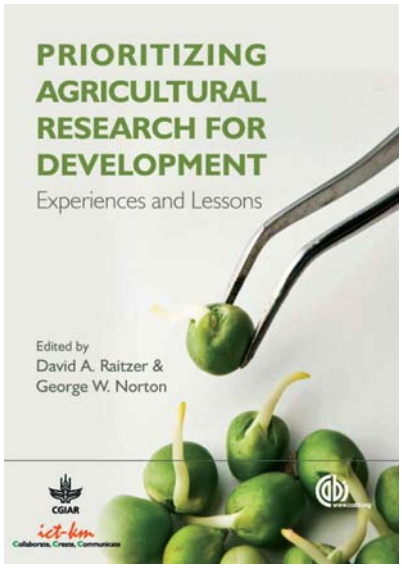
When I was a boy in New York City in the 1940s, I remember putting a penny in a nut dispensing and getting either a few pinenuts (we called them Indian nuts) or red pistachios. The pistachio nuts were delicious, worth every cent. I always thought pistachios were red until in the 1980s when amber colored 'Kermen' pistachio from California hit the market. I soon learned that the red color in imported pistachios was a dye to hide shell staining by species of the *Aspergillus* fungus. Furthermore, Professor Damiano Avanzato has informed me that this fungus can produce an aflatoxin that is carcinogenic. I have since discovered the delectable use of pistachios in baclava and other mideastern delicacies as well as pistachio flavored ice cream, which is usually colored green.

Imagine my delight when the story of pistachio was published in *Scripta Horticulturae* 7, the second in a series that includes almond (*Scripta* 4) and chestnut (*Scripta* 9). This volume, edited by the indefatigable Damiano Avanzato and co-edited by Ignazio Vassallo is written in Italian in one column and translated in English in the other. It contains information from 18 countries and is profusely illustrated. I learned a great deal about the history, botany, economy, and uses of this delectable nut and so will you. I urge all horticulturists with an interest in nuts to add it to their library.

Reviewed by Jules Janick, Purdue University, USA

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

Prioritizing Agricultural Research for Development: Experiences and Lessons, David A. Raitzer [formerly at the Centre for International Forestry Research, Bogor Barat, Indonesia] and George W. Norton [Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA] (eds.). 2009. CABI Publishing, Wallingford, Oxfordshire, United Kingdom. 234p. ISBN 9781845935665 (hardcover). £75 / $150 / € 115. www.cabi.org



Raitzer and Norton are the editors of this 13-chapter, multi-author book on priority assessment methods. This book helps bringing back the focus on how decisions are made for using research resources. This well-written book builds on the approaches of the Centers of the Consultative Group on International Agricultural Research (CGIAR), which extensively used priority setting to allocate public research funding aiming for great impact through a consolidated research-for-development focus, thereby avoiding research dispersion. As stated by the CGIAR Science Council *"projects addressing difficult issues for sustainable poverty reduction (e.g. smallholder productivity gains in Africa) need sharply focused, long-term, and multi-pronged approaches involving research on different commodities, themes, and disciplines"*. A clear priority research agenda showing the routes of poverty will surely assist development investors for allocating their funding to projects with potentially great impacts.

Although priority setting methods are well-known and used in commodity improvement programs, they are still under refinement for other research areas such as natural resource management or policy, whose impact pathways are more difficult to predict. Two terms are used frequently by the authors of this book: 'priority assessment' or the systematic analysis of potential research alternatives, and 'priority setting' or how actual decisions are made regarding the portfolio of research activities pursued by an institute as well as relative resource allocation among them. Priority setting should indeed influence the resource allocation across research undertakings in any organization. The authors of each chapter provide an overview of their priority assessment methods as well as the strengths and weaknesses that will assist drawing lessons for further use. In some of the chapters, the authors include more participatory approaches to fully engaged scientists, research managers and external partners, as well as the use of geographical information systems (GIS) for targeting specific technologies. The book consists of four sections with the first section having two chapters, the first being an introductory chapter followed by one providing an overview about participatory impact pathway analysis (PIPA). The emerging PIPA tool offers managers a deeper understanding of the results that projects might attain with specific partners, helping therefore on setting priorities and supporting funding proposals. The second section (chapters 3 to 9) gives details of institute-level approaches such as those used by CGIAR Centers researching on crop improvement (chapters 4 for potato and sweetpotato, 8 for rice in Africa, and 9 for maize and wheat), eco-regions: sub-Saharan Africa and semi-arid tropics (chapters 4 and 6, respectively), forestry – which is policy-oriented towards conservation and environmental protection (chapter 3), and livestock (chapter 7). The third section deals with system and regional approaches drawing from a consultative process (in Central/West Asia and North Africa – chapter 10), a data intensive sub-regional approach (for Eastern and Central Africa – chapter 11), and the methodology taken by the CGIAR Science Council for "setting" a global agenda in international agriculture (chapter 12). Chapter 13 (in the fourth section) synthesizes ideas and lessons given in previous chapters, as well as identifies and highlights a few basic priority-assessment

principles to improve consistency in methods. It concludes with brief suggestions on priority assessment methods that incorporate impacts of natural resource management and policy-oriented research.

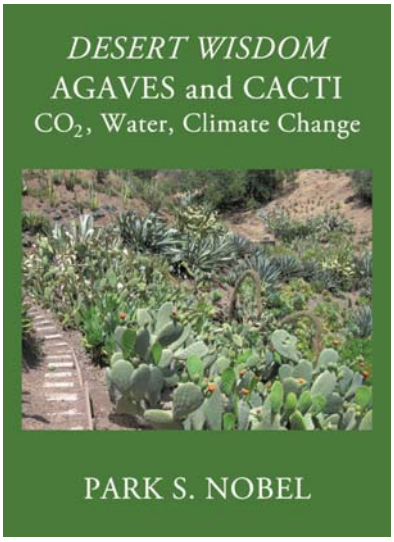
There are manuals on priority setting in agricultural research but this new publication brings a wealth of real-world experiences on defining priorities by organizations engaged in research-for-development. Hence, both policy makers and researchers in agriculture, as well as agricultural-related NGOs will benefit from reading this book because sound priority assessment will lead to great research impacts in agriculture.

Reviewed by Rodomiro Ortiz, CIMMYT, Mexico

Piccoli Frutti: mirtilli, lamponi, more, ribes, uvaspina – Come coltivarli, raccoglierli e utilizzarli (in Italian). (Berry Fruits: blueberries, cranberries, raspberries, blackberries, currants, gooseberries – Culture and utilization.) Giancarlo Bounous. 2009. Edagricole, Bologna, Italy. 393p. ISBN 978-88-506-5270-9. € 32. www.edagricole.it

This new technical book written by Giancarlo Bounous, with the cooperation of Gabriele Loris Beccaro and Maria Gabriella Mellano, is certainly the best edited by the Authors. The book is dedicated to growers and researchers but it is easy to be used also by amateurs who wish to be introduced to the world of berry fruits. The book gives a broad vision of all scientific and technical aspects related to berry fruit growing and utilisation of fruits. From breeding to nutritional standards and, eventually, useful recipes for berry fruits utilisation in gastronomy, the book also gives a detailed outlook of all cultivars of different berry species, including raspberry, blueberry, blackcurrant and cranberry.

Desert Wisdom / Agaves and Cacti: CO_2, Water, Climate Change. Park S. Nobel. 2009. iUniverse, Bloomington, IN, USA. 196p. ISBN 978-1440191510. $6 (ebook) / $16.95 (soft cover). www.iuniverse.com



The new book (ebook or soft cover) self published by Park S. Nobel on agaves and cacti, attempts successfully in to transmit the fantastic world of cacti and agaves, together with some basic science, to nonspecialists at a reasonable price. The reader will easily find his way through the wonderful world of agaves and cacti, widely different taxonomically, but remarkably similar physiologically in their ability to thrive under the higher temperatures, variable rainfall, and increased CO_2, characteristic of global climate change. The book delivers crucial scientific information on Crassulacean Acid Metabolism (Chapter 2), plant tolerances (Chapter 3), and crop improvements using an Environmental Productivity Index (Chapters 5 and 6). The reader is introduced to the uses of agaves and cacti (Chapter 1), climate change implications (Chapter 4), and bright ideas for coping with future climates (Chapter 7).

Above books were reviewed by Paolo Inglese, University of Palermo, Italy

STOLO, volume 2, Switzerland (in German). Uwe Schneider and Gert Gröning. 2010. Wernersche Verlagsgesellschaft, Worms am Rhein, Germany. 413p. ISBN 978-3-88462-279-7. € 29.80. www.wernersche.com

Some 5.000 titles of professional articles and monographs as well as garden culturally significant references are listed in this STOLO volume 2. Numerous further hints to literature in general and more specific bibliographies, as well as a large number of hints to libraries and other institutions with special meaning for the history and theory of garden culture make this volume a much more comprehensive research instrument than commonly known bibliographies.

Some 3.200 titles are given for garden culturally meaningful bibliographies and book indices. Some 24.300 titles are listed in bibliographies of neighboring disciplines where the Swiss-related percentage is much lower, of course. General as well as local and regional bibliographies contain further titles. Frequently monographs and single articles listed in the various chapters of the volume hold comprehensive lists of special literature as well as archival and other sources. The STOLO volume Switzerland lists independent literature and articles as well as chapters in books, which in most cases have been evaluated both qualitatively and quantitatively. The volume also has an index of libraries and further institutions of considerable significance for garden culture and open space development both on state and private levels. Next to printed sources this STOLO volume for Switzerland brings to the attention numerous internet sources. The volume provides quick and professional insights into sources of information and organisation of garden culture in Switzerland. On one hand the book is meant to bring to the attention a single book as well as a single article. On the other hand it is meant to serve independent and efficient studies by lay people as well as students and teachers who want to get acquainted with professional literature and who share an interest in more specific research.

Authors' comments

NEW TITLES

Pridgeon, A.M., Cribb, P., Chase, M.W. and Rasmussen, F.N. 2010. Genera Orchidacearum. Volume 5. Epindendroideae (Part Two). Oxford University Press, Oxford, UK. 585p. ISBN 9780198507130 (hardcover). $195.00. www.oup.com

Hickman, Gary W. 2010. International Greenhouse Vegetable Production – Statistics. 2010 Edition (e-book). Cuesta Roble Greenhouse Vegetable Consulting, Mariposa, CA, USA. 51p. $135. www.cuestaroble.com

Section Citrus

Second Int'l Citrus Biotechnology Symposium

Participants of the Symposium.

The Second International Citrus Biotechnology Symposium was held in Catania, Italy, from November 30 to December 2, 2009. The symposium was organized by the Department of Horticulture and Food Technology of Catania University under the aegis of the International Society for Horticultural Science and the International Society of Citriculture. At the opening ceremony Prof. Alessandra Gentile, Symposium Convener, expressed a cordial welcome to all the participants. She was followed by Prof. Luis Navarro, Chair of the International Society of Citriculture and by Prof. Paolo Inglese, who, on behalf of the ISHS, handed over to the Conveners, Prof. Alessandra Gentile and Prof. Eugenio Tribulato, the ISHS medal in recognition of their meritorious service to the Society.

This symposium followed the one organized in Eilat, Israel, in 1998 that was dedicated to the memories of two Israeli scientists: Professor Bar Akiva and Professor Monselise.

More than 120 participants from 18 countries among which the most important citrus producers (Brazil, China, Cyprus, Greece, India, Iran, Israel, Italy, Japan, Morocco, Oman, South Africa, Spain, The Netherlands, Tunisia, Turkey, Uruguay, USA) attended the Symposium.

129 abstracts were received and collected in the "Second International Citrus Biotechnology Symposium Book of Abstract". 52 papers were presented as oral and 47 as posters, in seven sessions, on a wide range of topics relating to citrus biotechnology. Every day the conference was opened with a keynote lecture.

The symposium consisted of the following sessions:

- First day
  - Session 1 - Genomics: structural and functional genomics, genetic and physical mapping, sequencing, cytogenetic studies
- Second day
  - Session 2 - Genetic transformation: technical advancements, applications for rootstock and cultivar improvement and functional genomic studies
  - Session 3 - Environmental and physiological stress: molecular tools and physiological methods for screening
  - Session 4 - Biotic stress: detection and control of the major pests and diseases
- Third day
  - Session 5 - In vitro culture applied to breeding and propagation
  - Session 6 - Molecular biology of plant and fruit growth and ripening
  - Session 7 - Fruit quality, health and nutrition including studies on volatiles, flavor, and nutraceutical compounds

The first session was introduced by Prof. Manuel Talon from the Centro de Genómica, Instituto Valenciano de Investigaciones Agrarias, who presented an interesting keynote lecture on "Citrus Genomics". He talked about the application of genomic tools on citrus, underlining the importance of genome sequencing to extend knowledge on plant development and on its interaction with the environment. Then, during the first day, researchers presented their studies about genomics and molecular characterization of citrus species and varieties in their countries. During the second day, the activities were introduced by Prof. Mark Hilf from Florida Horticultural Research Laboratory, who delivered a lecture on "*Citrus Tristeza Virus*: some perspectives on an important global pathogen of citrus" relating to one of the more dangerous diseases for citriculture that needs an important engagement for researchers in many countries. During the discussions about Genetic transformation (session 2), Environmental and physiological stress (session 3) and Biotic stress (session 4) researchers presented reports about characterization of new *Tristeza* tolerant rootstocks. These rootstocks were evaluated in combination with the main

Prof. Eliezer Goldschmidt talking about his work on chlorophyll breakdown in citrus.

The symposium Convener Alessandra Gentile (center) with Fred Gmitter (left) and Mikael Roose (right).

varieties of orange and tangerine. Furthermore, innovative techniques for fast disease diagnosis were illustrated. These methods based on capillary electrophoresis of single strand nucleic acid are also used for viral strain characterization.

In the last day of the symposium main topics were: in vitro culture applied to citrus breeding (session 5), in particular to obtain ploidy variation and new rootstocks; molecular biology of plant and fruit growth and ripening (session 6); fruit quality, health and nutrition (session 7). During the last session interesting topics about nutraceutical properties of citrus and, especially, healthy effects of anthocyanins in blood oranges, were discussed.

At the end of the symposium the Convener, on behalf of the Organizing Committee, thanked all the participants for coming to the meeting.

The meeting was concluded with the farewell dinner at Palazzo Biscari, one of the most elegant buildings in Catania.

Besides the scientific sessions, the participants had the opportunity to visit the collection of fields and the nursery facilities of "Palazzelli" Farm of Centro di Ricerca per l'Agrumicoltura e le Colture Mediterranee of The Agricultural Research Council (CRA) and the laboratories of the Science and Technological Park of Sicily.

The Second International Citrus Biotechnology Symposium gave the opportunity to the researchers from different countries to present the results of their work, to share their experience, to establish close relations, and to discuss the possible development of activities regarding biotechnological studies on citrus.

Marco Caruso, Gaetano Distefano,
Giuseppina Las Casas and Stefano La Malfa

Visit to the laboratories of the "Science and Technological Park of Sicily".

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Castanea 2009, First European Congress on Chestnut

Participants of the Symposium.

The 1st European Congress on Chestnut (*Castanea* 2009) was held in Cuneo (Italy) from 13 to 16 October 2009. The congress was organized under the auspices of the International Society for Horticultural Science (ISHS) and the Italian Society of Horticultural Science (SOI), together with the 5th Italian Congress of Chestnut. This cooperation allowed involving a larger number of experts.

More than 300 scientists, researchers, industry managers, farmers, policy makers, students and technicians involved with science and business of chestnut, attended *Castanea* 2009. Countries represented other than Italy included Albania, Australia, Brazil, Bulgaria, People's Rep. of China, Croatia, Czech Republic, France, Greece, Hungary, Japan, Lebanon, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, South Korea, Switzerland, The Netherlands, Turkey, United Kingdom, and United States of America for a total of 25 countries, representing 4 continents.

The congress coincided with the XI National Chestnut Fair, the largest Italian commercial fair and exhibition on chestnut. This choice has been appreciated by the participants who had the opportunity to visit the numerous stands and participate in different cultural events organized during and after the congress.

The opening ceremony started with the cordial welcome speech of Dr. Alberto Valmaggia, Mayor of Cuneo, followed by the address of Prof. Elisabetta Barberis, Dean of the Faculty of Agriculture, University of Torino. Dr. Damiano Avanzato, Chair of the ISHS Section Nuts and Mediterranean Climate Fruits, gave an update on ISHS activities and membership and Prof. Paolo Inglese, President of the Italian Society for Horticultural Science, emphasized the role of R&D for the progress of horticulture. Dr. Mino Taricco and Dr. Claudio Sacchetto, the authorities representing the agricultural sector of Piemonte Region and Cuneo Province respectively, Prof. Sergio Giraudo on behalf of the Local Bank Foundations, and Mr. Marcello Gatto, representative of the Local Chamber of Agriculture and Commerce, welcomed the audience. In his opening remarks Prof. Giancarlo Bounous, Chairperson of the ISHS Working Group on Chestnuts and Convener of the event, stated that the chestnut has not only a glorious past but also a promising future. The nuts, which are in shortage in the world market, are sold as a large array of commodities; timber and coppice are used in many ways and the species is a good contributor for carbon sequestration in the atmosphere and, in addition, the renewable energy and biomass produced by the chestnuts can reduce our dependence from fossil fuels. Furthermore, in mountainous and marginal areas the chestnut ecosystem plays a fun-

The welcome of authorities and scientific organisation representatives. From left: Damiano Avanzato, Chair of the ISHS Section Nuts and Mediterranean Climate Fruits; Ugo Boccacci, Comunità Montana Valli Gesso e vermenagna; Alberto Valmaggia, Mayor of Cuneo; Giancarlo Bounous, Convener of the event; Mino Taricco, Agricultural Sector representative of Piemonte Region; Claudio Sacchetto, Agricultural Sector representative of Cuneo Province; Elisabetta Barberis, Dean of the Faculty of Agriculture; Paolo Inglese, President of the Italian Society for Horticultural Science.

Century old chestnuts.

Chestnut harvesting.

damental role in soil protection and in the perspective of social welfare. Among the other authorities Dr. Mercé Rovira, coordinator of the FAO CIHEAM - Nut network, presented the activity of the network.

A total of 210 papers (1 plenary, 8 invited, 85 oral and 116 posters) were presented during the European and Italian congresses. The 7 sessions concerned: history, landscape and ecology; biology and genetic resources; chestnut culture; pests and diseases; economics and marketing; harvest, post-harvest, quality and processing; biomass and energy.

The session on history, landscape and ecology was opened by the plenary lecture entitled "The European civilization of the chestnut woods" given by Prof. Jean-Robert Pitte (France) who said that in the Mediterranean ecosystems "*in the Middle Ages and Renaissance and on acid soils, the chestnut tree produced more calories per acre than cereals*". The session, moderated by Dr. Víctor Galán Saúco (Spain) and Marco Conedera (Switzerland) was rich of contributions: among others the talks regarded the natural and landscape values of the chestnut ecosystems (Prof. Marco Devecchi), a review of the perspectives of the chestnut between the second and third millennium (Dr. Mario Adua) and chestnut wood in cultural heritage (Agresti et al.) In the late morning, Dr. Damiano Avanzato presented the ISHS volume of the series *Scripta Horticulturae*: "Following Chestnut Footprints" (editors Damiano Avanzato and Giancarlo Bounous). The text, written by authors with a deep knowledge and experience on chestnut research, deals with culture, folklore, history, gastronomy, cultivation and management of the species in 27 countries and on 4 continents. In the afternoon Prof. Santiago Lorenzo Pereira (Spain) was the chairman of the second session focused on biology and genetic resources and opened with the lecture titled: "An integrated approach to assess the genetic and adaptive variation of *Castanea sativa* Mill." Other papers were focused on breeding, genetic diversity, and molecular characterization of chestnut genotypes. The third session on chestnut culture was moderated by Prof. Tiziano Caruso and opened by Prof. Afonso Martins (Portugal) with an invited lecture on different orchard management techniques and their effects on productivity and sustainability. The session was also related to the actions to restore chestnut plantations, considerations about the effects of cultural practices in chestnut stands, grafting and micrografting techniques.

The fourth session, chaired by Dr. Stephanos Diamandis (Greece) and Prof. Andrea Vannini (Italy) and focused on pests and diseases issues, was very rich of presentations (18 talks) and covered many topics, in particular the biology and control of the gall wasp (*Dryocosmus kuriphilus*), a new insect recently introduced in Europe. The keynote speaker, Prof. Alberto Alma with the lecture: "The Italian experience in fighting *Dryocosmus kuriphilus*. Reproducing, spreading and setting of *Torymus sinensis*" provided a complete overview on the subject. Other papers concerned canker blight and ink disease control. The fifth session was focused on economics and marketing issues and two keynote speakers highlighted the situation of the culture in Italy (Prof. Carlo Prirazzoli) and in China (Prof. Qin Ling), by far the leading producer of chestnuts in the world. The session was moderated by Prof. Arif Soylu (Turkey) and Prof. Laszlo Radocz (Hungary).

Harvest, post-harvest, quality and processing issues were discussed in the sixth session (chairperson Prof. Pietro Piccarolo) and the keynote speaker, Prof. Dennis Fulbright (USA), presented the lecture: "Efficacy of postharvest treatments for reduction of molds and decay in fresh Michigan chestnuts". The last session (chairman Prof. Sanzio Baldini) was devoted to biomass and energy production: a very interesting approach in perspective of global climatic changes and fossil fuels shortage. The invited speech of Lauteri et al. studied the chestnut as a model tree species to develop long term strategies for the conservation of its genetic resources in face of global climatic change; Prof. Gallardo Lancho emphasized the potentiality of carbon sequestration of chestnut systems of the Iberian Peninsula.

In the evening of the first day of congress, at the Faculty of Agriculture was inaugurated Expo-Castanea, an exhibit organized by Dr. Gabriele Beccaro in cooperation with Prof. Elvio Bellini. The Expo presented "the chestnut world" and all that it includes: semi processed and processed traditional and innovative produce for an increasing demand market (dried chestnuts and chestnut flour, honey, flakes, *marrons glacés* and in syrup, creams, beer or liquors, etc.). Samples of the best chestnut cultivars were also presented. At the Expo twelve private companies doing business in production, nut and timber processing, furniture, tannin, pellets, and machinery for chestnut processing, presented their activities and interacted with the participants. The Expo was also opened to the visitors of the Chestnut Fair and to the students of the local primary and high schools: a good way to disseminate information and knowledge around the chestnut world.

The technical visits provided a range of different experiences. The participants chose from the two possibilities offered: a visit to the technical structures of storage, packaging and chestnut processing industries or a field tour. During the "industry tour" participants visited Agrimontana Ltd., a leader company for the production of *marrons glacés*, and Ballario Ltd., involved in fresh chestnut sorting, storage and packaging. In the field tour the participants assisted to a demonstration of mechanical harvesting (Monchiero and Chianchia companies) and pruning through the technique of tree climbing. Old plantations and modern chestnut orchards were also visited. In the old plantations of Susa

valley the participants were welcomed by the notes of the songs of a mountain choir in a typical ethnic costume. During both visits the owners of the farms or food industries offered the participants typical cakes and roasted chestnuts.

Participants and accompanying persons were entertained at the welcome dinner offered by the Mountain Community and during several lunches where they had the opportunity to taste the local wine & food specialities and enjoy the concert of the Cuneo symphonic orchestra. During the interval of the concert Mr. Ugo Boccacci, president of the local Mountain Community, awarded the students with the best thesis on chestnut argument.

Furthermore, *Castanea* 2009 was organized paying attention to the environmental cost of such kind of events. In order to make the congress more "environmentally friendly", the organizing committee decided to apply the international procedure (protocol EMAS-ISO 14001) for the quantification of the CO_2 emitted. To balance the amount of the CO_2 produced by *Castanea* 2009 the Organizing Committee decided to devolve part of the registration fees to the Otonga Foundation in Ecuador, in order to compensate for the produced CO_2 emissions.

At the business meeting the participants voted that the 2nd European Chestnut Congress will be held from 9 to 12 October 2013 in an itinerant way: Hungary (Debrecen), Romania and Slovak Republic.

The congress was a great opportunity for the participants to share a lot of information, experiences and knowledge. Feedback from the participants indicated that they enjoyed the technically informative, warm and friendly feeling of the event.

The photo gallery of the event is available on the official web site of the congress (http://www.arboree.unito.it/castanea2009).

Giancarlo Bounous and Alessandro Cerutti

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Sixth Int'l Symposium on Light in Horticulture

Section Ornamental Plants – Commission Horticultural Engineering – Commission Protected Cultivation

The Sixth International Symposium on Light in Horticulture was held on November 15-19, 2009 at the Tsukuba International Congress Center (Epochal Tsukuba) in Tsukuba, Japan. The Symposium was organized under the auspices of the Society of Agricultural Meteorology of Japan (Committee Horticultural Engineering) and the ISHS (Commission Horticultural Engineering, Commission Protected Cultivation, and Section Ornamental Plants). The former symposia had been held with a specific focus on artificial lighting since 1969. This sixth Symposium focused on not only artificial lighting for plant production but also the use of natural light in protected horticulture. The Symposium was attended by 225 participants from 23 countries.

The Symposium consisted of three days of technical sessions and one day of technical tours. At the opening ceremony, Dr. Sadanori Sase, Convener and Chair of the Executive Committee, opened the Symposium with welcoming words. Dr. Nicolas Castilla, Chair of the ISHS Commission Protected Cultivation, gave an update of the ISHS activities. Dr. Takeshi Horie, President of National Agriculture and Food Research Organization (NARO), which was a sponsor of the Symposium, also welcomed the participants.

The opening ceremony was followed by two keynote lectures. The first keynote lecture was given by Dr. Silke Hemming, Wageningen UR, Chair of the ISHS Working Group Light in Horticulture, and was titled "Use of natural and

Keynote lecture by Dr. Silke Hemming.

Symposium banquet with the koto musical performance.

Participants of the Symposium.

artificial light in horticulture – interaction of plant and technology". The second lecture was delivered by Dr. Hiroyuki Watanabe, Tamagawa University, titled "Light-controlled plant cultivation system in Japan - History, today's developments and the future".

The parallel oral sessions followed four invited lectures: Dr. Eiji Goto, Chiba University, "Production of pharmaceutical materials using genetically modified plants grown with artificial lighting"; Dr. Yosepha Shahak, A.R.O. The Volcani Center, titled "General overview on photoselective crop protection"; Dr. Erik Runkle, Michigan State University, titled "Energy-efficient greenhouse lighting of ornamentals"; and Dr. Rod King, CSIRO, titled "How plants respond to different light conditions". 54 oral presentations and 75 posters were included in the program. 14 oral sessions focused on: 1) Impact of light on edible and medicinal products and the nutritional properties (two sessions); 2) Manipulation of light in greenhouses and growth rooms; 3) Light environments in greenhouses; 4) Interactions between light and other growth factors on growth and development; 5) Photoselective films and colored nets for greenhouse or field production; 6) Growth responses under various light conditions; 7) New equipment and technologies for lighting; 8) Supplemental lighting; 9) Artificial light sources such as LEDs and advanced lighting devices; 10) Light condition and floral induction (two sessions); and 11) Photosynthesis and growth (two sessions). Poster sessions took place on the fourth day in the same room where 20 commercial companies exhibited their products and technologies in totally 15 booths. Luncheon seminars were held each day by totally three commercial companies and the participants also enjoyed the bento box lunch.

At the closing ceremony, the concluding remarks and the future perspectives were given by Dr. Jorunn E. Olsen, Norwegian University of Life Sciences, from a biological point of view, and Dr. Wei Fang, National Taiwan University, from a technical point of view. A presentation for the invitation to the next seventh Light Symposium held in the Netherlands, October 2012 was given by Dr. Silke Hemming. The invitation to the IHC held in Lisbon and the Greenhouse2010 Symposium at the IHC was also presented by Dr. Nicolas Castilla and Dr. Sadanori Sase. The Symposium was formally closed by Dr. Eiji Goto, Chair of the International Scientific Committee and Chair of the Organizing Committee.

During the Symposium, the participants and accompanying persons enjoyed several social events. At the symposium banquet, they enjoyed Shabu-shabu cuisine (sliced well-marbled beef and vegetables served with dipping sauces) and the wonderful music of the koto (Japanese stringed musical instrument). Some of them experienced the Japanese tea ceremony in a specially-designed tinny room in the Congress Center.

The last day of the symposium was devoted to two technical tours. The participants in one tour visited a plant factory at Q.P. Corporation, and a Japanese sake brewery, Yamanaka Brewery. The participants in another tour visited Tsukuba Agricultural Research Gallery, National Institute of Agrobiological Sciences, and National Institute for Rural Engineering. Both tours finally met and visited a closed plant nursery system at Center for Environment, Health and Field Sciences of Chiba University. Pre- and post-tours for a small group were organized. The former visited a genetically modified plant factory at Hokkaido Center of National Institute of Advanced Industrial Science and Technology, and a plant factory complex at Jinnai Farm 21. The latter visited Fukui Plant Factory of Fairly Angel Inc. and Kyoto-Kitayama Factory where the participants tasted the vegetables produced by the plant factory.

Sadanori Sase and Eiji Goto

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Seventh Int'l Peach Symposium

Participants of the Symposium.

Peach is the third most important fruit crop in the world. But its cultivation is not free of problems. Peach expansion has been limited by its narrow range of climatic adaptation. It flowers early and is quite sensitive to frost, and yet, it has chilling requirements that are not met in some of the temperate zones and in the subtropics. Peach trees are vigorous, however, peach production systems are quite intensive. Techniques that can control excessive vigor are then required for reducing mutual shading and harvest costs. Improving fruit quality is another important issue. Peach fruit is usually consumed fresh, is perishable, and does not respond well to cold storage. Improving fruit quality and reducing postharvest losses have been a focus for breeders and postharvest physiologists. Peach is grown mostly under irrigation even in many sub-humid areas, however, availability of water for irrigation is increasingly under pressure.

The 7th International Peach Symposium was aimed at debating the current problems of peach production such as those outlined above. The Symposium was organized by IRTA (Insitut de Recerca i Tecnologies Agroalimentàries) and under the aegis of ISHS in Lleida, Spain, on 8-11 June 2009. The major public funding sponsors were the Spanish Instituto Nacional Investigaciones Agrarias (INIA), the Spanish Consolider program through RIDECO project, the Council of Lleida, the Departament d'Agricultura, Alimentació i Acció Rural (Generalitat de Catalunya) and the Diputació de Lleida. The industry sponsors were Asofruit, Catalonia Qualitat, Actel, Fruits de Ponent SCCL, Luqsa, Regaber, Hidromatic, Copersa, Lab-Ferrer, La Caixa, Viversa, and SolFranc Tecnologias, S.L.

The Symposium was opened with an address by the General Deputy of the Agriculture Department from the local government of the Generalitat de Catalunya Mrs. Rosa Cubel and the Director of IRTA at Lleida Dr. Conxita Royo who welcomed all participants on behalf of the Organization Committee. Prof. T.M. DeJong (Vice-Chair of the ISHS Section Pome and Stone Fruits) represented the ISHS in welcoming the delegates.

There were 199 participants from 5 continents and a large array of countries such as Argentina, Australia, Brazil, Bulgaria, China, Czech Republic, France, Greece, Hungary, Iran, Israel, Italy, Japan, Mexico, New Zealand, Pakistan, Poland, Romania, Russia, Serbia, Slovenia, South Africa, Spain, Taiwan, Tunisia, Turkey, Uruguay, USA, and Venezuela.

Sessions were devoted to Breeding Programs, Rootstocks, Fruit and Tree Development, Pests and Diseases, Biotechnology, Irrigation & Fertilization, Orchard Systems, and Postharvest & Fruit Quality. On the first day of the scientific program the following invited papers were presented "Recent results in the non-melting peach breeding of Embrapa, in Southern Brazil" by M.C. Bassols, "Using concepts of shoot growth and architecture to understand and predict responses of peach trees to pruning" by T.M. DeJong, and "Area wide management of mediterranean fruit fly (*Ceratitis capitata*)" by J. Avilla. On the third day of the program, the invited papers were "Peach fruit quality: Candidate genes or map-based cloning strategy?" by E. Dirlewanger, "Deficit irrigation strategies for peach orchards" by E. Fereres, and "Horticultural efficiency of peach planting systems in south Italy" by T. Caruso. "Comparative transcriptomics between cold-tolerant and cold-sensitive peach siblings reveals the participation of both preformed and induced mechanisms in tolerance to CI mealiness" by A. Granell was the last invited paper presented in the last day.

On the second day, a technical tour was organized in order to introduce to the attendees the expansion of peach cultivation in the area of Lleida. The visiting sites included the Experimental Research Station of Lleida-IRTA

Participants visiting the IRTA Lleida Field Station at Gimenells (Lleida-Spain).

Participants visiting the "Fruits de Ponent" packing house at Alcarràs (Lleida-Spain).

(where different crop growing techniques and plant performance assessment criteria were presented), a wine cellar, a packing house, and an irrigation district area.

An open session chaired by the Convener of the Symposium was introduced in-between regular sessions during the third day of the Symposium. The open session covered topics that had immediate applications and was aimed at the industry to give a broad picture of the state-of-the-art in peach research. For this reason free access for the scheduled two hours of the session was granted. Subjects as diverse as fruit thinning, trends in rootstock use, irrigation, and market issues towards acceptance of specific cultivars or sensory attributes of peaches on market preferences were presented in this session. At the end of the day sessions the participants enjoyed a classical music concert held at the 'Auditorium of Lleida', followed by the Gala dinner in which the participants could enjoy the traditional Catalan food.

Discussions throughout the Symposium were lively and several aspects from the peach growing fields up to the final market place were debated. At the orchard level, consideration was given to training systems and plant density emphasizing that good high density systems are advantageous primarily when fruit prices are high but when fruit prices are low or unpredictable, lower density and lower inputs systems are more favorable. The challenge is to develop systems that are inexpensive and productive. In regard to rootstocks, progress has been slow, but interest in vigor-reducing rootstocks is maintained. So far rootstocks with medium vigor look more agronomically interesting than those with large control over vigor. Another area in which new rootstocks are needed is for solving the problem of replanting situations. Understanding of how peach trees grow and how they respond to pruning interventions has lately been improved through modeling. This is helping to predict tree responses to both canopy and crop load management and to improve the way these practices can be applied to optimize fruit yield and size. Considerable progress has been made in other areas such as in predicting bud development dates in spring and how differences in bud development relate to quality differences at harvest. Peach growing in warm climates is also a relevant issue and understanding the genetics of blind nodes of peaches grown in low chill areas has been debated. From irrigation and fertilization perspective the following aspects can be outlined: i) minimum input of nutrients and water should be researched especially for their effect on yield and quality, ii) establishment or discovery of relationships between radiation environment and crop water use to refine irrigation scheduling protocols, and iii) continued research is needed on effectiveness of remote sensing in quantifying the orchard environment.

Improving fruit quality by developing new cultivars was a cornerstone of biotechnology applications for peach trees. The complete peach sequence will soon offer a lot of possibilities. New candidate genes will be researched but we still need: i) good material with good progenies (near isogenic lines are very important to be well phenotyped), and ii) proteomics, metabolomics, genetics, genomics and transcription should be applied as an integrated program. The final aim should be producing Marker Assisted Selection (MAS) tools that could improve the efficiency of current breeding programs by introducing novel attributes, and for improving fruit quality in a more sustainable way. In the Breeding session emphasis for varieties and rootstocks was on: new agronomic and field traits, new peach and nectarine varieties, and added resistance to diseases, pests, and abiotic stresses. Concern was expressed for the lack of coordination between public and private research programs and loss of relevant information as a result. The relevant information to be secured will be on segregation of traits, parental line choices, and sources of resistance. It was stated that there is a need for cooperation among breeders, geneticists, biotechnologists, pathologists, and market and buyer experts. Biotechnology should integrate the breeding planning by MAS, DNA analysis of traits, genotyping, and fingerprinting.

The organizers would like to extend their thanks to all participants and contributors for a very fruitful and enjoyable meeting and look forward to the next meeting, which will be organized in southern Italy.

Joan Girona

Dr. Girona, Convener, receiving the ISHS medal from Prof. Ted DeJong, ISHS representative at this Symposium.

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Twelfth Int'l Asparagus Symposium (IAS 2009)

Participants of the Symposium.

The XIIth International Asparagus Symposium was held from October 29th to November 1st, 2009 in Peru. This Symposium was organized by Universidad Nacional Agraria la Molina (UNALM) and Instituto Peruano del Espárrago y Hortalizas (IPEH, Peruvian Asparagus and other Vegetables Institute). Approximately 400 participants attended this symposium with 43% coming from other countries such as USA, Mexico, Germany, Japan, Spain, The Netherlands, Italy, Canada, Chile and so on.

Research works were presented in two categories, poster (30 in total) and oral (46 in total) presentations. Crop management, pest management, breeding, physiology and marketing were the main topics.

After the opening ceremony, a variety of crop management papers were presented. Mikolaj Knawflesky, Chair of the ISHS Working Group on Asparagus, showed the evolution of the asparagus crop in the world. Other research works were related to fertilization trials, irrigation management, living mulch effects, forcing culture, high density planting and soil amendments.

On the second day, pest management research works were presented. The first presentation showed the integrated pest management in asparagus developed in Peru, Other presentations showed studies about the incidence and control of insect pests such as Copitarsia, Prodiplosis and diseases like Fusarium, Phytophthora, Stemphylium or Phoma.

Visit to DANPER, an asparagus processing plant in Trujillo, La Libertad.

From left to right: White asparagus spear, Guillermo Van Oordt (Past President IPEH), Leyla Rebaza (Technical Assistant, IPEH), Martin Perez (Head, Department of Foreign Trade and Tourism), Carlos Zamorano (General Manager, IPEH), green asparagus spear and Flor Ortiz (Assistant, Organizing Commitee IAS 2009).

The third day was dedicated to the advances in asparagus breeding. Important research works about new interspecific hybrids, micropropagation, and use of SSR markers were presented. An important presentation was "Sequence Variation in the Sex-Determination Region of Garden Asparagus" because it will help to understand the evolution of sex chromosomes besides helping in breeding purposes. Physiology topics also were presented this day. The importance of the root system in the use of the Aspire System was discussed. Other reports were related to yield and biomass production, bud formation and soluble solids content in the root system, light condition and rutin and polyphenol contents in asparagus spears.

The topic discussed during the last day of the symposium was marketing. The key speaker Chris Martin with his work entitled "North American Fresh Asparagus Market: Historical Data Leading Future Predictions" gave important information about the reduction tendency in the number of hectares of asparagus in California, Mexico and Peru. Also IPEH President, Jose Gal'Lino, gave a brief history of the Peruvian canned asparagus industry.

It is also important to mention that tours to La Libertad and Ica took place before and after the symposium. In both of them, participants could visit different fields of green and white asparagus and packing houses. The companies that they visited were Danper and Camposol in Trujillo area, and Corporación Beta and Agrokasa in Ica. The participants received information about the particularities of the asparagus cultivation under Peruvian conditions. Participants also visited packing houses of fresh and canned asparagus. They could observe harvest procedures, post harvest handling and processes related to fresh and canned asparagus production.

In conclusion, the symposium was a great opportunity for scientists from all over the world to share the new advances of their research works, to learn about the trends in asparagus research, and also because they could use that information to improve the asparagus cultivation in their fields and in their countries.

Andres V. Casas Diaz and Karin Coronado

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Fruits is available also through www.pubhort.org

Int'l Symposium on High Technology for Greenhouse Systems (GreenSys2009)

GreenSys2009 participants during the visit of the Horticultural Research Centre of Laval University and BBQ event (Tuesday afternoon and evening).

For the first time in the history of ISHS symposia on High Technology for Greenhouse Systems, joint scientific (3 days) and technical (2 days) programs rallied scientific and industrial communities (471 participants from 34 countries) under the same event to discuss key topics on: greenhouse design and systems; efficient energy and resource use; greenhouse management and abiotic stresses; modeling; microclimate; robotics and sensors; controlled environment technology and use; fertigation and management of growing media; plant protection; sustainable growing systems; and organic crop systems. A total of 158 scientific presentations, 33 technical presentations and 125 posters were presented, and 164 manuscripts will be published in a volume of *Acta Horticulturae*. Two ISHS Commissions (Horticultural Engineering, Protected Cultivation), four ISHS Working Groups (Modelling Plant Growth, Environmental Control and Greenhouse Environment; Computational Fluid Dynamics; Greenhouse Design; Sensors in Horticulture), two North American (NCERA-101, NE-1035), and two international (ICCEG and FAO) working groups also joined GreenSys2009 for this unique event held in Québec City, Canada, and organized by Dr. André Gosselin (Université Laval) and Dr. Martine Dorais (Agriculture and Agri-Food Canada).

As energy efficiency and sustainability are the main challenges of Northern and Southern countries, new technologies and integrated approaches were proposed to reduce the use of fossil energy by using greenhouse covers with higher insulating values in winter and reduced heat load in summer, efficient thermal screening and cooling strategies, and renewable energy sources such as wind, solar, and geothermal energy. The use of wood biomass and anaerobic digestion of greenhouse waste products or photobioreactors were also proposed as promising avenues. In order to take advantage of the free solar radiation, new types of greenhouses were proposed to collect and store this energy. Double glasses with new anti-reflection coatings, high light transmission and lower k-values were proposed to improve energy saving. Using new concepts of climate control strategies like temperature integration, a further reduction of energy consumption is possible. Plant selection and breeding for adapted rootstocks and varieties to low or high temperatures will also contribute to energy saving and better water use efficiency.

In several countries closed and semi-closed greenhouses, where excess of solar energy in summer is collected and stored in aquifers to be reused in winter to heat the greenhouse, are gaining popularity due to their advantage in elevating the CO_2 level for better plant production, and reducing CO_2 emission, pest infestation, water use and energy consumption. This closed concept was stated as a powerful tool in a strategy towards independency of fossil energy sources and to reduce the carbon footprint of greenhouse production. Higher tomato yields (14 to 34%) were reported with 20 to 30% less fossil fuel in a closed greenhouse compared to an open one. However, to take full advantage of this high investment technology and reduce disease incidence such as botrytis, climate factors and management practices should be optimized such as the cooling air distribution, plant or stem density and root zone conditions. In order to optimize climate factors, CFD analyses were performed. The use of fine wire heat exchangers to heat and to cool a greenhouse crop or an open water/air heat exchanger (droplet curtain) were developed for closed greenhouse cooling.

Improvement of microclimate control for low-energy greenhouses via on line plant monitoring, advanced sensor technology and algorithms, better understanding of the impact of climate change and variability on crop production by modeling as well as the development of decision support systems for the industry, are essential for the state-of-the-art of the greenhouse agrotechnology. Consequently, mechanistic models that integrate fruit fresh and dry weight production with overall plant water and carbon status as well as fruit set or abortion models were presented. For a better yield prediction, 3D functional structural models for the simulation of light interception on an individual leaf basis were proposed. The need for model simplicity versus complexity in relation to QTL related processes was discussed. To realize an optimal control of greenhouse crop irrigation

From left to right: Martine Dorais and André Gosselin (Conveners), Stefania De Pascale, Nicolas Castilla (ISHS representative), Juan Ignacio Montero and Sadanori Sase (ISHS representative).

Dr. Leo Marcelis during the visit of the greenhouse research facility, Horticultural Research Centre.

and reduce water consumption, crop dynamic transpiration models or models based on passive renewable energy systems were presented.

Pest control researchers showed how seasonal climatic conditions (temperature, light intensity, photoperiod, supplemental lighting, humidity) affect the parasitism and predation levels of parasitoids and predators. To exploit pesticide free techniques to control pests and diseases, qualitative multicriteria approaches have been proposed. The efficiency of insect screens and photoselective covering materials for insect population control and the performance of new biological control agents were reported. The possibility of detecting pathogen infections such as *Botrytis cinerea* before appearance of visible symptoms by climate monitoring or by their emitted volatiles, were discussed in terms of early warning systems.

Fertigation management of high performing sustainable growing media was proposed, and examples of compost suppressiveness against a wide variety of microorganisms were shown for different types of crops. Sustainable strategies were proposed to reuse or treat waste products such as wetlands, bioreactors and biofilters. For Northern growing conditions, the environmental impact of using high tunnel compared to greenhouses was presented. Several countries promoted the transition to and the development of organic farming. In The Netherlands, a decision support model for organic growers was developed and validated by growers combining the database with existing models on N-dynamics, crop nutrient demands and the water balance of crops and soil. North American results showed that yields as high as conventional greenhouse crops can be achieved under a bed container organic crop management when effluents are recycled.

Future commercial greenhouses are expected to use engineering to produce with minimal or zero emissions. Development of new niche market products such as functional foods, plant-made vaccines and bio-pharmaceuticals offer great opportunities for the greenhouse industry but require new structural and operational approaches for commercial production of this plant biomass.

The next GreenSys 2011, organized by Professor C. Kittas, Dr. N. Katsoulas, and Dr. T. Bartzanas will be held in Greece from June 5-10, 2011. Meanwhile, IHC2010 in Lisbon, Portugal (August 22-27, 2010) will hold the Symposium Greenhouse 2010: Environmentally Sound Greenhouse Production for People.

Martine Dorais and André Gosselin

Dr. Blanche Dansereau was in charge of the visit of the Horticultural Research Centre laboratory facilities.

Contact

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Commission Quality and Post Harvest Horticulture

Southeast Asia Symposium on Quality and Safety of Fresh and Fresh Cut Produce (SEAsia 2009)

Group photo of keynote speakers, invited speakers and oral presenters.

The Southeast Asia Symposium on Quality and Safety of Fresh and Fresh Cut Produce (SEAsia 2009) held in Thailand on August 3-5, 2009 at the Radisson Hotel, Bangkok was organized by the Division of Postharvest Technology, King Mongkut's University of Technology Thonburi (KMUTT) under the auspices of the International Society for Horticultural Science (ISHS) - Commission Quality and Postharvest Horticulture.

At the opening ceremony, Assoc. Prof. Dr. Kraiwood Kiattikomol, President of KMUTT, welcomed 156 participants from more than 24 countries to the symposium. Dr. Bernhard Brückner, Chair of the ISHS Working Group on Vegetable Quality, gave an update of ISHS activities. In the first keynote presentation, Dr. Robert Premier, from Salad Fresh, Global SF ptyt Ltd, Australia delivered his experience on the fresh cut industry focus on quality issues that start from the farm and go through to the plate of the customer. Dr. Marita Cantwell from UC Davis, USA presented her paper on quality challenges for fresh cut products. The Symposium brought together many eminent researchers and industry experts from several disciplines to discuss the development and innovation in quality and safety management with the goal to supply quality of fresh and fresh cut in an affordable and sustainable manner to customers in the future global economy.

The first two days of the symposium were devoted to 12 keynote and invited speakers, 29 oral and 70 poster presentations on a diversity of topics including preharvest conditions on quality, safety and longevity of fresh and fresh cut produce, postharvest physiology, postharvest pest management, postharvest physical treatments, storage and transport technology, innovation packaging, managing food safety risks, market and distribution systems.

There was considerable discussion among the symposium delegates on the trend for research needs in finding new potential of quality and safety of fresh cut produce as well as postharvest management systems that are more effective than existing ones. Dr. Stanley J. Kays, University of Georgia, USA presented his keynote address on "Quality Maintenance of Fresh Produce". Consideration was also given to the development of technologies for safe fresh and fresh cut produce.

The final day of the symposium was a study tour to the modern nurseries that produce ornamentals in Bangsai Garden Orchids Paradise and continued to "The Ancient City" and "Bangsai Arts & Craft Center" in Ayudhaya Province.

Participants and accompanying persons were entertained at a welcome reception featuring a wide variety of wonderful Thai foods and entertainment including Thai classical music and dance performed by graduate students of the Division of Postharvest Technology, KMUTT.

Associate Prof. Dr. Kraiwood Kiattikomol, President of KMUTT, welcoming the participants.

Dr. Bernhard Brückner, Chair ISHS Working Group on Vegetable Quality, presenting the ISHS activities.

Thai classic dance performed by graduate students of Division of Postharvest Technology, KMUTT, during the Welcome Reception.

This Southeast Asia Symposium on Quality and Safety of Fresh and Fresh Cut Produce was highly valued as exemplified by the internationally recognized scientists from many countries. This symposium emphasized the need for quality and safety management throughout the supply chain in particular for fresh and fresh cut produce.

The proceedings of the symposium will be published as a volume of *Acta Horticulturae* and copies of the proceedings will be available from ISHS.

Sirichai Kanlayanarat and Chairat Techavuthiporn

Contact

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Commission Quality and Post Harvest Horticulture

Postharvest Pacifica 2009

A most successful Symposium "Postharvest Pacifica 2009", a joint scientific meeting involving the ISHS "Managing Quality in Chains" Symposium together with the Australasia Postharvest Conference, was held at Napier in the fruit, vegetable and wine centre of New Zealand, 16-19 November 2009. More than 160 participants from 21 countries registered and they revelled in the fantastic sea views from the conference centre, marvelled at the excellent quality of local foods and wine, while still finding time to listen and learn from more than 60 oral and 53 poster presentations on a diverse range of postharvest and supply chain topics. The symposium was organised into 16 separate oral sessions and two workshops: Supply Chain Workshop, and Market Access Workshop.

The oral sessions comprised: consumers and world trends; understanding texture; market access and disinfestation; quarantine and plant pathology; health and nutrition; nondestructive approaches for determining quality; physiology; supply chains; consumers and supply chains; logistics and management of perishable supply chains; 1-MCP and ethylene; preharvest factors and maturity; fresh cut; using 'omics' to understand postharvest biology; ethylene and modified atmospheres; and packaging and storage.

Dr. Pol Tijskens, Wageningen University, The Netherlands, opened the Symposium with a provocative and challenging address "Consumers and Food Choice: Quality, Nutrition and Genes" where he addressed the questions: Why and what do we eat? He postulated that human feeding behaviour with the urge to consume energy rich food is driven by an urge to proliferate the genes involved in reproduction; reproduction of genes is more important than the health of the individual body.

Dr. Alan Woolf (left), Plant and Food Research Institute, and Professor Errol Hewett (right), Massey University, Co-Conveners of Postharvest Pacifica 2009, with Dr. Susan Lurie (center), Vice Chair Commission Quality and Postharvest Horticulture.

The culmination of a 7 year collaborative programme between Australia and New Zealand, "Vital Vegetables" was reviewed by Dr. Rod Jones, Victoria Department of Primary Industries, Australia in his keynote address. He reported on the recent release of "Booster Broccoli" for commercial adoption. The outcome of this programme was the result of a coordinated effort between scientists, growers, and market firms to produce and market a range of vegetables with enhanced nutritional attributes and that are thought to protect against human diseases.

Professor Bart Nicolai, Katholieke Universiteit Leuven, Belgium, addressed the potential of "Metabolomics in Postharvest". In particular he stressed the potential of metabolomics for rapid phenotyping of new genotypes; identification of markers for postharvest disorders (including GABA as an early marker for identifying internal browning in pears); metabolite flow analysis in fruit and vegetables (fluxomics); and kinetic modelling. A brief description of new techniques for rapid, specific and comprehensive detection and quantification of metabolites was outlined. A tantalising idea offered was the potential to develop a synthetic fruit design that may be possible to achieve when enough metabolomic information becomes available.

Dr. Michelle Jones, Ohio State University, USA,

Professor Siachol Ketsa, Thailand (left), Dr. Pol Tijskens, The Netherlands (center), and Dr. Barry McGlasson, Australia (right) receiving their Certificate of Appreciation for Contributions to Postharvest Science from Dr. Ian Ferguson, Professor Errol Hewett, and Dr. Jenny Jobling, respectively.

provided an overview of "Proteomic Analysis of Petal Senescence" with the model plant Petunia. Programmed senescence of petals allows plants to remobilise nutrients from the dying flowers. 133 proteins were identified, 88 up-regulated and 45 down-regulated. Many of the up-regulated proteins seem to be involved in the flower stress response, as well as catabolic processes including degradation of nucleic acids, proteins, lipids and cell walls.

"Postharvest Science and Value Chain Management: where's the common ground?" was the title of the keynote address by Professor Ray Collins, University of Queensland, Australia. He introduced the audience to the 'Virtuous Value Cycle', a concept that allows individual firms to identify their potential as value chain partners, or groups of collaborative firms to evaluate their performance as a value chain. A current example of this system was a project involving Pakistan and Australian collaborators (private and public sector involvement) working to develop a system to deliver Pakistani mangoes to the European supermarket system. The move from firms being independent to becoming interdependent is a key element for successful establishment of horticultural value chains in the future.

Ethylene is a key naturally occurring chemical that plays a vital positive or negative role in development, maturation, ripening and senescence of fruit, vegetables and flowers. Two keynote presentations were delivered on ethylene. Professor Chris Watkins, Cornell University, USA provided a wide ranging address on "Managing Physiological Processes in Fruit and Vegetables with Inhibitors of Ethylene Biosynthesis and Perception". Following a brief outline of some new developments in non-chemical methods to reduce the affects of ethylene, including ozone, he indicated that aminovinylglycine (Retain®) was undergoing a resurgence in use as tool for preharvest use in conjunction with postharvest 1-MCP (SmartFresh℠) application. 1-MCP has had a dramatic influence on the pipfruit industry by enabling substantial extensions of storage life. Development of 1-MCP as a spray, as distinct from gaseous, application has shown great promise for application to field crops (Invinsa™) and fruit crops (Harvista™) with the latter chemical having gained registration approval in the USA. Experimental use of 1-MCP has potential to provide insights into maturity related issues, physiological disorders both pre- and postharvest, chilling injury, and for further understanding storage potential of tropical fruit.

Dr. Nagin Lallu, Plant and Food Research, New Zealand discussed "Challenges in Commercialisation of SmartFresh℠ in the Asia Pacific Region" outlining the success obtained with deriving protocols for use on the major apple cultivars with different supply chain configurations. Influences of factors such as timing and temperature of applications after harvest and maturity at harvest were illustrated. The potential use of SmartFresh℠ on tropical fruits is real but protocol development similar to that used for apples, pears and plums is required before this technology can be used successfully for mango, avocado and other fruits grown in Asian and Pacific countries.

Professor Gene Kupferman, Washington State University, Wenatchee, USA, summarised recent research on developing protocols for "Optimising 'Anjou' Pear Quality to meet Consumer Demand". Consumers require 'ready to eat' pears within 4 days of retail purchase with fruit removed from coolstore over several months of the cool storage period. Ethylene was necessary to speed fruit conditioning and consumer studies delineated specific targets for the pear industry in Washington and Oregon. Much of the knowledge required to develop successful protocols has been available in the scientific literature for many years, but a disconnect between growers, packhouses, shippers and retailers had prevented development of successful marketing strategies until now.

Two very successful workshops were held on "Market Access Issues" and "Supply Chains" at which representatives from different countries and industries exchanged views on current issues and potential strategies for future R&D and cooperation.

An extremely successful social programme included lunch and wine tasting at a local vineyard/winery (Church Road), a fantastic dinner/dance at the Mission Estate (where the quality of a range of local New Zealand wines astonished and satisfied participants), and a BBQ held at Plant and Food Research Centre where excellent wine and boutique beers were available for sampling. A prior technical tour of the research centre highlighted the concentration on new cultivar creation through breeding, development of orchard management techniques and development of systems to achieve ultra low or nil detectable chemical residues without sacrificing pest and disease control (the "Apple Futures" programme).

Presentations were made to Dr. Barry McGlasson (Australia), Dr. Pol Tijskens (The Netherlands) and Professor Saichol Ketsa (Thailand) as recognition by the profession for their outstanding contributions to Postharvest Science during their distingished careers.

The best poster presentation at the Symposium was by Dr. Jinquan (Ringo) Feng, Plant and Food Research Institute, the best student poster was by Jovyn Ng, and Emma Tacken had the best student oral presentation (both University of Auckland).

The venue for the next "Managing Quality in Chains – MQIC" has not been finalised as yet but will probably be held in Europe in 2013. The next Australasian Postharvest Conference will be convened by Dr. Rod Jones, Victoria Department of Primary Industries in September 2011.

Errol W. Hewett and Allan Woolf

Conference venue in Napier for the Postharvest Pacifica 2009 Symposium.

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International Conference on Horticulture (ICH-2009) - Bangalore, India

Participants during the Inaugural Session of ICH-2009.

The International Conference on Horticulture (ICH-2009) with the theme "Horticulture for Livelihood Security and Economic Growth" was held in Bangalore, Karnataka State, India during November 9-12, 2009. It was organized by Dr. Prem Nath Agricultural Science Foundation (PNASF), Bangalore in association with Vegetable Science International Network (VEGINET), Bangalore and University of Agricultural Sciences (UAS), Bangalore in collaboration with national and international organizations like, Indian Council of Agriculture Research (ICAR), New Delhi; Ministry of Agriculture and Cooperation, Government of India; Planning Commission, Government of India; National Horticulture Mission, New Delhi; Karnataka Department of Horticulture; FAO, Rome; International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India; International Center for Agricultural Research in the Dry Areas (ICARDA), Syria; AVRDC – The World Vegetable Center, Taiwan; International Center for Underutilized Crops (ICUC), Sri Lanka and others.

OBJECTIVE

The objective of the conference was to develop a plan to guide the development of cost-effective and efficient horticultural interventions to generate additional employment and income opportunities, crop diversifications through increased production and consumption of horticultural crops, provide better food and nutritional security, and improve health status by prevention of non-communicable diseases and micronutrient deficient disorders, all leading to livelihood security of farmers, particularly small and marginal ones, and overall economic growth in the interest of both producers and consumers.

PARTICIPANTS AND SESSIONS

About 750 delegates from 40 countries including Asia and the Pacific, Africa, Central Asia, Europe, Middle East and United States participated in the deliberations of the conference. There were 17 technical sessions including a seminar, covering six theme areas viz; Technological Domain; Institutional and Policy Support: Socio-Economic Domains; Producer – Consumer Domain; Technical Cooperation among Developing Countries (TCDC); Challenges and Opportunities in Horticulture - Seminar; Plenary Session: Opportunities and Future Thrusts. A total of 650 presentations including 35 lead lectures, 250 oral and 365 poster presentations were given. The Dr. B.P. Pal Memorial Lecture entitled "Horticulture and Health: Ancient and Medieval Views" was delivered by Professor Jules Janick, USA and the Dr. Norman E. Borlaug Memorial Lecture entitled "Changing patterns of consumption, economic growth and food security: examining India's experience in a global context" was delivered by Dr. Keith Wiebe, FAO, Rome. As a part of the conference, FAO sponsored HORTIVAR Training was also organized where about 100 scientists, professors, students and progressive farmers were trained.

Poster session.

PNASF International Gold Medal Award to Prof. Jules Janick (top), Dr. Mahmoud Solh (center) and Dr. Remi Nono-Womdim (bottom).

RECOMMENDATIONS

1. The Conference recognized horticulture as the second line of defense with cereals and legumes serving as the first line in the food domain. It was estimated and stated that horticulture (a) supports significantly food security, (b) is the major contributor of nutrition security, (c) promotes good health, and (d) is source of employment generation – all leading to livelihood security and further economic growth.
2. The technological advancements were recognized and the contributions accounted. Some of the highlights were as follows;
   - 2.1 Attention may be given to breeding varieties that can grow with low-input agro techniques and in an extended growing season, and to develop varieties and production technologies suitable to urban and peri-urban locations.
   - 2.2 Underutilized, under-exploited volunteer and wild genotypes that offer livelihood security for tribal and ethnic communities should be promoted in the native form by research organizations and NGOs.
   - 2.3 Research work should be augmented on promoting fruits, vegetables, spices, medicinal and aromatic plants to preventing various non-communicable diseases, and on antioxidants and nutraceuticals in collaboration with WHO, FAO and other institutions.
   - 2.4 Use of biotechnological tools and genetic engineering is less pronounced in horticultural crops, particularly in developing countries, and should be strengthened and accelerated. Emphasis should be laid on specific traits like resistance to insect pests, drought and heat tolerance and extension of shelf-life of produce.
   - 2.5 Global quality parameters should be standardized for various fruits and vegetables, spices, tuber crops and flower crops, and Good Agricultural Practices and Good Handling Practices should be developed for each crop to enhance competitiveness and promote exports. Likewise, this should be popularized amongst the small and marginal farmers.
   - 2.6 Protocols/technologies may be developed/standardized for production of botanicals/plant products, bio-pesticides, bio-fertilizers and bio-control agents at the farm gate levels and unemployed youth may be trained for production of these in order to reduce production cost, generate gainful employments and prevent migration to urban areas in search of employment.
   - 2.7 There is a need to study and understand agro-ecosystems diversity with respect to horticultural crops and its impact on livelihood security. In this context bio-intensive farm modules involving various horticultural crops need to be developed and promoted.
   - 2.8 Cost effective hybrid seed production protocols may be developed to reduce the cost of hybrid seeds, which can be affordable by small and marginal farmers. Phytosanitary certification standards for various seed and plant materials of horticultural crops for imports/exports need to be reviewed.
   - 2.9 Various organic cultivation practices in vogue for different horticultural crops should be validated scientifically and cost-benefit ratios should be worked out. Among the developing nations, the Transfer Technology Structure needs a drastic change in order to meet the needs of the rural population.
   - 2.10 Awareness and education programme on food, nutrition and health security should be launched.
3. To build awareness of supply chain and value chain among the farmers.
4. A wealth of technical information and ample number of technologies available but not accessible could be sourced through networking of institutes and organizations for exchange of information, seed and plant materials and expertise. The FAO under the umbrella of Technical Cooperation among Developing Countries (TCDC) has successfully implemented a special programme for food security in low-income-food-deficit countries under South-South co-operation and may act as facilitator for formation and strengthening such networks like VEGINET (Vegetable Science International Network).
5. Horticultural education and research is not attracting the younger generation and talents at expected levels worldwide. At this juncture, it is essential to update the university syllabus, improve the quality of research, which should be more farmer's driven and not scientist's driven.
6. The recommendations emerging out of this conference should be distributed among all the stakeholders and government organizations for possible implementation and policy interventions by the governments.

HONORED ATTENDANCE

The importance of the conference was highlighted by the presence of His Excellency The Governor of Karnataka, Mr. H.R. Bhardwaj, as the Chief Guest who inaugurated the conference and graced by Minister of Agriculture, Mr. S.A. Ravindranath; Minister for Major and Medium Irrigation, Mr. Basavaraj S. Bommai, Government of Karnataka; Mr. M.V. Rajasekharan, former Union Minister of State for Planning; and Professor V.L. Chopra, former Member, Planning Commission, Government of India as Guests of Honor. Dr. Prem Nath, Chairperson, Organizing Committee, ICH-2009 delivered the keynote address. The inaugural audience was welcomed by Dr. P.G. Chengappa, Vice-Chancellor, University of Agricultural Sciences, Bangalore.

NATIONAL AND INTERNATIONAL AWARDS

Another highlight of the conference was the International and National Gold and Silver Medal Awards for known personalities who had contributed significantly to agriculture/horticulture, food and nutritional security. The recipients of the international gold medal awards by the Chief Guest were Prof. Jules Janick, Distinguished Professor of Horticulture, Purdue University, USA (Promotion of Horticultural Science); Dr. Mahmoud Solh, Director General,

ICARDA, Syria (Promotion of Dryland Horticulture), and Dr. Remi Nono-Womdim, Agricultural Officer (Horticulture/Vegetable Crops), Plant Production and Protection Division (AGP), FAO, Rome, Italy.

The PNASF National Gold Medal Awards were given to Dr. R.S. Paroda (Promotion of Agricultural Research); Dr. Anupam Varma (Promotion of Plant Protection Research); Dr. S. Bisalaiah (Promotion of Economic Agriculture); Prof. R.S. Deshpande (Research on Agriculture Policy); and Dr. K.V. Peter (Promotion of Horticulture Science). The PNASF Silver Medal Awards were given to Dr. K.R.M. Swamy, Dr. B.S. Prabhakar and Dr. D.P. Kumar of Bangalore for promotion of vegetables and horticulture.

EXHIBITION

An exhibition showcasing the products and technologies developed by private, public and NGOs in the field of horticulture was arranged for the benefit of the delegates. A post-conference study tour was also arranged for interested delegates. Overall the conference was a success, benefiting various stakeholders of horticulture sector.

Prem Nath

CONTACT

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FROM THE SECRETARIAT

New ISHS Members

ISHS is pleased to welcome the following new members:

NEW INSTITUTIONAL MEMBERS:

Canada: Olds College Library; **Malaysia:** Malaysia Pineapple Industry Board

NEW INDIVIDUAL MEMBERS:

Algeria: Prof. Dr. Nadia Bouguedoura; **Argentina:** Dr. Carlos Alberto Parera, Dr. Francisco Rousset, Dr. Ruben Simonetta; **Australia:** Mr. Rudi Bartels, Dr. Surya Bhattarai, Mr. Scott Brady, Mr. Kevin Chen, Dr. Fiona Constable, Mr. Graham Court, Ian Daynes, Mr. Peter Deuter, Mr. Alex Doyle, Ms. Susan Dutton, Ms. Nancye Ellis, Mr. Kevin Finnemore, Mr. Craig Gribble, Mr. Robert Gulack, Ms. Elysia Harrison, Mr. Allan Hendry, Mr. Babis Lagos, Mr. Steven Lorimer, Dr. Ping Lu, Mr. Robert Matthews, Mr. Stepan Melkonian, Dr. Kenneth Menz, Mr. David Morcombe, Mr. Andrew Routley, Mr. Graeme Smith; **Bahamas:** Prof. Dr. Earele Johnson; **Belgium:** Vincent Claux, Ms. Joline Jammaers, Mr. Jeroen Kellers, Ms. Wendy Odeurs, Dr. Stijn Van Laer, Mr. Nico Vergote; **Brazil:** Prof. Dr. Joao Farias, Dr. Giuliano Elias Pereira, Mr. Rodrigo Real, Prof. Dr. Marco Antonio Silva Vasconcellos; **Bulgaria:** Mr. Rossen Nikolaev Gorgorov; **Canada:** Assist. Prof. Robert Bors, Mr. Bains Dalbir, Mr. Ousmane Doukara, Mr. David Foisy, Denise Fontaine, Prof. Dr. Hong Li, Manu Malenfant, Mr. Telesphore Marie, Ms. Kristin Murray, Mr. Kenneth Roth, Mr. Milad George Zakhia; **Chile:** Veronica Gonzalez, Prof. Dr. Johanna Martiz, Mr. Juan Ignacio Pasten, Prof. Dr. Jose Rodriguez; **China:** Ms. Qing Chen, Dr. Shiwei Song, Dr. Juan Xu, Ms. Xin Yue; **Chinese Taipei:** Mr. Meng Hsun He, Mr. Chia-Tse Liu; **Colombia:** Mr. Jorge Eliecer Quintero; **Croatia:** Mr. Antonijo Mihaljevic; **Czech Republic:** Dr. Milos Michlovsky; **Ecuador:** Ms. Mary H. Evans, Mr. Santiago Teran; **Egypt:** Mr. Ibrahim Ismail; **Fiji:** Mr Suliasi Tawake; **Finland:** Henri Hyytiäinen, Mr. Pertti Rajala, Mr. David Stokes, Markku M. Unnaslahti; **France:** Ms. Alexandre Bout, Ms. Cécile Bresch, Mr. Richard Brun, Dr. Rachel Carol, Dr. Julien Cases, Mr. Henri Duval, Mr. Hicham Fatnassi, Jacques Fersing, Mr. Miles Gaisford, Mr. Cyriaque Le Gouguec, Ms. Marie Madeleine Muller, Ms. Pia Parolin, Ms. Jeannine Pizzol, Christine Poncet; **Germany:** Mr. Gökhan Akyazi, Oliver Bitz, Mr. Heinz Munder; **Greece:** Dr. Georgios Koubouris, Mr. Styn Leenders, Assist. Prof. Chryssoula Papaioannou, Eleni Pliakoni, Teodor Tachmatzidis; **Haiti:** Nancy Fombrun; **Hungary:** Mr. István Dániel Mosonyi, Ms. Veronika Szabó, Dr. Tibor Várszegi; **Iran:** Prof. Dr. Vali Rabiei, Dr. Ali Sorooshzadeh; **Iraq:** Mr. Mohammed Nada; **Ireland:** Adrienne Kelly, Prof. David O'Beirne; **Israel:** Mr. Yoram Zvieli; **Italy:** Dr. Giancarlo Babbo, Prof. Dr. Stefano Bona, Dr. Francesca De Lorenzi, Dr. Stefano Lucci, Dr. Maria Rosaria Taurino; **Jamaica:** Oniel Blair, Mr. Burrell Scarlett; **Japan:** Prof. Dr. Masaru Adachi, Prof. Dr. Motoaki Doi, Mr. Tesuo Funabashi, Mr. Tatsuru Jishi, Prof. Dr. Yasutaka Kano, Ms. Jung-Hee Kim, Prof. Dr. Yasuyuki Kubo, Ms. Rika Kurogi, Mr. A.S.M. Nahiyan, Dr. Kaori Sakai-Ogushi, Dr. Satomi Sakazono, Dr. Noriko Takahashi, Dr. Yoshiyuki Tanaka, Mr. Keisuke Tasaki, Prof. Dr. Hirofumi Terai; **Kenya:** Mr. Jackson Kiambi, Mr. Francis Michuki; **Korea (Republic of):** Dr. Ji Gang Kim, Mr. Yoon Cheol Roe; **Macedonia:** Assist. Prof. Margarita Davitkovska; **Malawi:** Ms. Jarret Mhango; **Malaysia:** Dr. Mohd Nasaruddin Mohd Aris, Mr. Weesiang Ng; **Mexico:** Edmundo Mercado-Silva, Prof. Juan Roldan; **Mongolia:** Mr. Javkhlan Badam; **Morocco:** Dr. Mustapha Aitchitt; **Netherlands:** Mr. Bjorn Johannes Bunnik, Teake Dijkstra, Ms. Yvonne van der Klaauw-Perk, Mr. Roel Weijers; **Nigeria:** Assist. Prof. Fikayo Babatunde; **Norway:** Ms. Eli Ronglan; **Oman:** Dr. Ahmad Al-Bakri, Ir. Khair Al-Busaidi, Mr. Abdul-Aziz Al-Harithy; **Peru:** Mr. Guillermo Adawi; **Philippines:** Mr. Rex Victor Puentespina; **Portugal:** Dr. Ana Margarida Cavaco; **Romania:** Dr. Ion Caplan, Dr. Margareta Corneanu, Mr. Thomas Galambos, Dr. Minerva Heitz, Prof. Dr. Ion Mitrea, Dr. Costel Vanatoru; **Russian Federation:** Dr. Andrey Kuzin, Dr. Alexey Meshkov, Dr. Alexandr Nikitin, Dr. Aleksey Portyankin, Dr. Alexey Solomakhin, Dr. Vladimir Solopov, Dr. Natalia Tikhomirova, Prof. Dr. Yury Trunov; **Samoa:** Asuao Kirifi Pouono; **Serbia:** Jovan Crnobarac, Marko Doric, Vladimir Perisic; **Singapore:** Mr. Kokpiaw Chua; **South Africa:** Mr. Cristian Cernat, Mr. Gavin Olsen; **Spain:** Mr. Joaquín Berjano, Mr. Juan Jose Gonzalez Plaza, Dr. Sanchez Guerrero M. Cruz, Mr. Jose Antonio Morales Pérez, Dr. Manuel Rubio, Myriam Straub; **Sweden:** Mr. Amir Vadiee; **Switzerland:** Ms. Purnima Palkar, Reto Zehnder; **Tanzania:** Dr. Ruth Minja; **Thailand:** Ms. Junichi Keida; **United Arab Emirates:** Mr. Anwar Al-Braich, Irfana Shamim; **United Kingdom:** Mr. Ewan Barker, Assist. Prof. Peter Doerner, Mr. Idris El Tawil, Ms. Amy Ferrell, Mr. Richard G. Gaete-Holmes, Mr. Roger Hitchings,

Mr. Andrew Howe, Mr. Rob Levenston, Prof. Richard Mithen, Mr. Timothy Mugford, Mr. James Simpson, Mr. Anthony Smith, Mr. Michael Sun, Mr. Christopher Taylor, Mr. Brian Truckle, Dr. Harry Walton; **United States of America:** Mary Annen, Dr. Jinhe Bai, Benjamin Barnard, Mr. Daniel Boire, Ms. Jodi Bruns, Lucy Calhoun, John Carroll, Dr. Peter Charles, Kristina DeLion, Mr. Michael Dorris, Mr. Dan Dufault, Prof. Robert Ebel, Dr. Nancy Elliott, Gustavo Escobar, Dr. David Felicetti, Ms. Celina Fernandes, Mr. Daniel Fernandez, Ms. Barbara Fick, Mr. Francisco Gonzalez, Edward Harwood, Mr. Leo Hayes, Dr. Shashank Heda, Mr. Terry Hoyt, Mr. T.J. Hummer, Mr. Andrea Jackson, Dr. Allan James, Dr. Jiwon Jeong, Bob Jones, David Lau, Sarah Lovell, Mr. Renato Mateus, Dr. Charles Maynard, Dr. David McDaniel, David Miles, Dr. Gary E. Miller, Prof. Cary Mitchell, Dr. Rebecca Moes, Tom Nagel, Dr. David Norman, Erin O'Neal, Byron Phillips, Frances Pontasch, Ms. Abigail Post, Cecil Pounders, Virginia Povall, Prof. Dr. William Powell, Mr. Mario Restrepo, Samuel Reynolds, Jose Rivas, Erik Sacks, Dr. Bhaskar Savani, Mr. Charles Schultz, Ms. Genevieve Sharma, Dr. Gavin Sills, Ms. Parker Smith, Dr. Philip Stewart, Mr. Meng Y. Tee, Mr. Dave Terry, Barry Thoele, Ms. Ariana Torres, Mr. Darcy Turner, Mr. Scott Vandewalle, Ismael Vargas, Alicia Westonmiles, Ted Young, Dr. Gan-Yuan Zhong; **Zimbabwe:** Michael Browne, Mr. Henk Terblanche

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YEAR 2010

- 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, Dept. Agribusiness & Information Systems, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang Selangor, Malaysia. E-mail: nolila@agri.upm.edu.my Web: http://muresk.curtin.edu.au/research/conferences/ishs_2010/

- 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

- NEW July 20-22, 2010, Craiova (Romania): **II EUFRIN Plum and Prune Working Group Meeting on Present Constraints of Plum Growing in Europe.** Info: Dr. Mihai Botu, Fruit Growing Research & Extension Station , Valcea, Str. Calea Traian n. 464, 240273 Rm. Valcea, Romania. Phone: (40)250740885, Fax: (40)250740885, E-mail: stpomvl@onix.ro

- 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

- NEW 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 E-mail symposium: APS@kmutt.ac.th Web: http://www.kmutt.ac.th/APS2010/

- 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

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- 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.pt 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: pct-melo@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: isabel-mourao@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 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 E-mail symposium: IPPVS2010@abi.bg Web: http://www.ippvs2010.com/

- NEW 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.avenue media.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/

- NEW October 11-14, 2010, Bleiswijk (Netherlands): **International Conference on Organic Greenhouse Horticulture**. Info: Dr. Carin van der Lans, Research Organic Protected Horticulture, Wageningen UR Greenhouse Horticulture, Postbox 20, 2665 ZG, Bleiswijk, Netherlands. Phone: (31)317-485516, E-mail: carin.vanderlans@wur.nl Web: http://www.organicgreenhousehorticulture.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 Web: http://www.ishs.org/calendar/cactusVII_1stannouncement.pdf

- 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 - TropHort2010.** 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: http://www.inta.gov.ar/altovalle/Pears2010/index.html

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