Chronica Horticulturae

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ISHS

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CHRONICA HORTICULTURAE

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Cover photograph: Garland made in India of jasmine, crossandra, chrysanthemum, aster and foliage, see article p. 14

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ISHS

CONTENTS

Erratum

In the paper entitled "The Founding and Founders of the Royal Horticultural Society" that appeared in *Chronica Horticulturae* 48(1):17-19 an error was noticed in the first sentence of section 'The Early Society'. This sentence should be 'In 1805, Banks invited his friend Thomas Andrew Knight ...'.

The Tyranny of the Impact Factor

Jules Janick

Jules Janick, ISHS Board Member and Director of Publications

To: Abbot Franz Cyrill Napp, Augustinian Monastery of Brno

From: Bishop A.E. Schaffgotsche, Brno

Re: Gregor Mendel

February 1, 1868

The Archbishop of Prague has determined that monastery funds for the construction of a greenhouse have been used to support a research project concerning peas of Gregor Mendel, a member of your order, that may reflect on the effects of the study of science on the spiritual calling of the monastery. As a consequence, we have opened up an investigation to determine the value and impact of this research in two ways: peer review and a citation evaluation. We sent a paper entitled *Versuche über Pflanzen-Hybriden* (Experiments on Plant Hybrids) published in *Verhandlungen des naturforschenden Vereines in Brünn* 4:3-47, 1866 to the eminent Botany Professor Karl Wilhelm von Nägeli, who informed us that he had already received correspondence with Mendel about this topic. Professor Nägeli was unimpressed with the research but admitted he could not spare the time to read the entire document. He had suggested that Mendel should cease working with horticultural crops and investigate *Hieracium* (hawkweed), a truly botanical species.

We further tested the significance of the pea work through a two year citation analysis and found that the impact factor (derived from number of citations of the paper) had a value of zero. It has never been cited at all. We conclude that the lack of citations confirms the opinion of Professor Nägeli. In view of the poor review and low impact statement we suggest that Dr. Mendel ceases all research in this area. We strongly urge Father Mendel to find a better use of his time and we suggest administration.[1]

[1] Mendel assumed the position of Abbot on March 30, 1868.

Eugene Garfield, a linguist, is the remarkable founder of the Institute for Scientific Information (ISI). In the 1960s, Garfield came up with an intriguing concept that has become indispensable to the scientific community, one that he has bankrolled into an influential publishing industry. The concept is that citations in a scientific paper can be used to determine the importance of not only scientific research but also researchers and research journals (Garfield, 1979). The way it works is that ISI, using *a prescribed list of journals*, computerizes the citations *of each paper* of each issue and from this source of information extrapolates a number of intriguing statistics such as how many times a work is cited and who cites it. The basic assumption is that the importance and impact of a scientific work is directly related to the number of times it is cited. The current dogma is that if a paper is frequently cited it has high impact and is therefore important. The converse follows: if it is infrequently cited it has low impact and is unimportant. (There are some famous exceptions: see box above regarding Gregor Mendel, the author of the most famous paper in biology and horticulture.)

Based on this information, the concept of impact of a journal or a paper has been developed. Furthermore, journals can be rated on their importance by the number of times they are cited in their own journal and in other journals. (Of course, it is a bit depressing when you find that no one cites your paper but yourself.) Indeed, journals develop strategies to improve their impact factor by rejecting papers that they deem unworthy. A related H-index (Hirsch-index but often called the Heat Factor) integrates productivity and impact over a career (Vinkler, 2007). Introduced in 2005 by Jorge Hirsch, the index is a metric for estimating *"the importance, significance and broad impact of a scientist's cumulative contributions"* and takes into account both the number of an individual's publications and their impact on peers, as indicated by citation counts.

The impact factor concept has been bought, hook-line-and-sinker, by administrators worldwide. After all, what could be simpler than finding a specific number, like IQ, to evaluate performance. The mere quantity of publications is no longer of interest, but rather it is their impact vis-a-vis the impact factor. (Of course, many administrators are more interested in how much funding you can garner.) More and more the careers of young researchers appear to be dependent on this statistic. As a result some young, ambitious scientists are reluctant to publish in low impact journals. Even scientists from undeveloped countries have succumbed to this concept and they increasingly want to know the impact factor of journals chosen for submission. Sadly, the impact factor can be gamed: to increase your impact factor: make sure you are included as coauthors and cited in your colleagues' papers by promising to include them in yours; self citation will help you directly; avoid anything that will prevent you from publishing in a less prestigious journal lest it ruins your chances for acceptance in a higher impact journal.

Clearly, the concept of impact has merit in some areas, molecular biology for example, but works less well in others. In many fields of applied science such as engineering where research is often published from proceedings, technical reports, and patents, the impact factor is clearly not as appropriate. And, it cannot be denied that we in horticultural science and particularly ISHS, are suffering from this statistic. Horticulture journals deal with a small (and decreasing) specialized audience and so citations as measured by ISI will be low, even for the most outstanding papers. ISHS is in the unfortunate position of being subject to the fact that ISI, *a private organization*, determines what journals are to be considered science in their world. *Acta Horticulturae*, because it does not meet ISI's criterion of a journal (it is not published in regular installments, for example), is excluded (although some "selected" issues are included in the "book citation index"), and thus, its citations are not considered. This is despite the fact that there are currently almost

800 *Actas* with more than 40,000 articles available on line with a consistent pattern of over 28,000 daily page views. In essence, ISI by choosing the journals that it considers worthy of counting citations, determines what is to be considered science and undervalues what is excluded. For example, review articles published in scientific journals are highly cited, and authors get a large impact factor, while review journals such as *Horticultural Reviews* and *Plant Breeding Reviews*, are not counted because they come out annually and are not considered journals. ISI also does not include journals from less developed countries.

There are some other strange things. The citation does not discriminate between first names. Thus, Jules Janick is cited as J. Janick. Thus I am pleased that my citation index is increased because ISI mixes up Jules Janick and John Janick. I suspect the Parks, Kims, Lees and Wus will be pleased to see their citations increasing. The citation index does not distinguish self-citation (hint to authors: do not be bashful, cite yourself).

We can agree that the Impact Factor is a serious threat to horticultural science in general and to ISHS in particular, since its main publication, *Acta Horticulturae*, despite its usefulness, is not a prescribed journal of ISI where citations are enumerated. Can anything be done about it? Probably not much. We have tried pleading with ISI to include *Acta Horticulturae*, probably the most cited horticultural publication ever, but we have not been successful. Suing ISI does not seem to be a logical approach. We have attempted to determine our own impact factor by keeping records of downloads on our website but it is doubtful if they will be accepted by those in other fields or will influence administrators. Perhaps we should just be stoic and accept the fact that life is just not fair, that we need to believe in ourselves and in the fact that horticulture is important, that we serve a useful function, and stop worrying about something that we cannot control.

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Issues

Orchard Tourism in China

Zhou Wu-zhong and Chen Xiao-yan

Fruits are among the earliest plants cultivated in China and are beloved because of their diversity, their delectable flavors, their beauty, and their place in the landscape. Visiting orchards for recreation has become an important tourist activity in large metropolitan areas such as Beijing, Shanghai, Guangzhou, and Shenzhen. Although a huge market for tourist sites exists in China, only 20 of 203 "National Agricultural Tourism Demonstration Plots" recognized by the National Tourism Bureau involve orchards. The planning and construction of orchards specifically designed for tourists is now underway.

THE TOURIST ORCHARD

The tourist orchard, as the name suggests, is a combination of tourism and orchard culture. This comprehensive concept integrates sightseeing, recreation, ecology, the local economy, and science popularization. The development of tourist orchards combines improvement of the fruit industry, expansion of leisure time activities in rural areas for urban citizens, and the promotion of the local tourist industry. With its tremendous multiplier effect, it can boost the prosperity of local economies.

Tourist fruit picking in China has become an important recreational activity in many metropolitan areas such as Beijing, Shanghai, Guangzhou, Xiamen, and Shenzhen. Data from the Beijing Fruit Tree Association indicates 533 public tourism and picking orchards in Beijing, with a total area of 19 thousand hectares. In 2002, the total income of farmers in suburbs of Beijing was 97.3 million yuans (1 yuan = US$ 0.14), producing 3.4 kg of fruit per capita. In the same year, the income from public harvest of cherries was more than 5 million yuans, about a third of the total return for cherries. At present, the average profit of some tourist orchards is 2882 to 3293 yuans per hectare; the highest could be 12,000 yuans per hectare. Tourist orchards have become a new cash crop for farmers in Beijing.

The National Tourism Bureau in China advocated the development of industrial and agricultural tourism in 2001 and developed *Inspection Standards of National Industry and Agriculture Tourism Demonstration Tests* in 2002. By the end of March 2004, more than 340 departments in 31 provinces underwent self-examination, provincial preliminary inspection, and applied for national inspection. Based on the results of this national inspection, 203 attractions were named "National Agricultural Tourist Orchards" by the National Tourism Bureau, although less than 20 included the word "orchard" in their names. Examples include the Taoyuan World Eco-Agricultural Tourist Attraction in Feicheng, Turfan Grape Ditch, Xinglong Town Ten Thousand Mu Tourist Orchard in Chengdu, Hongyang Chinese Gooseberry and Green Tea Base in Du Jiangyan, Mengzi County Ten Thousand Guava Orchard in Yunnan, Nanfeng Luoli Sweet Oranges Eco-orchard in Jiangxi.

Although sightseeing combined with fruit picking has been increasing in China with considerable physical and financial resources expended, many orchards are still not built up to standard, with poor accessibility, incomplete infrastructures and facilities, lack of diversity in products and programs, substandard service, and poor management. Some orchard managers appear to be unaware of the national inspection, or if they knew, paid little attention to it.

TOURIST ORCHARD CONSTRUCTION AND MANAGEMENT

Currently most of Chinese tourist orchards are developing on the basis of traditional orchards. Although the ownership of some tourist orchards has been transferred to individuals,

Vineyard Tourism. A. The Nanjing Jiangxin Island Grape Orchard (National Agricultural Tourist orchard). B. Picking grapes. C. Squeezing grapes for juice. D, E, F. Nanjing Jiangxin Island Grape Festival, 2006.

most of them are still managed by farmers or pomology specialists. It is generally agreed that more attention must be paid to construction and management.

Idea Transformation

The transformation of ideas reflects the transformation of values. Traditional orchards mainly focus on planting and cultivating fruit trees, and selling their fruit. The value and revenue of the products are limited. Tourist orchards are totally different. The core value of tourist orchards lies in the sightseeing experience (Table 1). The transformation from production orchard to tourist orchard goes far beyond the name change, rather it is a change of concept: *"the focus must be on a sight seeing experience while the acts of cultivation and fruit selling are merely complementary."* Thus, the principal solution for the development of Chinese tourist orchards is the transforming of management, avoiding the ordinary agriculture management model and attempting to involve the model of the booming tourism industry. Tourist orchards need to be constructed and managed as a tourist attraction not as a working farm. It requires embarking on a new track for further development.

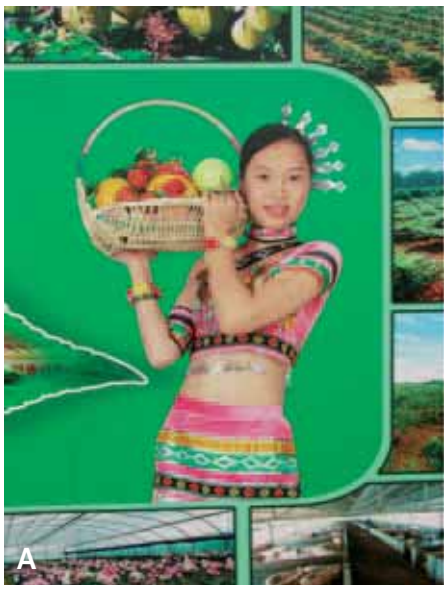
Table 1. A comparison of traditional and tourist orchard.

Category market	Targeted products	Major activities	Activities	Time for activities	Life cycle	Ultimate profit
Traditional orchard	Mainly farmers	Fruit	Production	Seasonality	The cycle of fruit trees	Sales revenue of fruit
Tourist orchard	Non-farmers and urban dwellers	Fruit, orchards, experience, amenities	Management of tourist activities	All seasons	The tourist cycle	Sales revenue of fruit, and visitor expenditures

Planning

The principle of planning is essential for a well developed tourist orchard. Tourist spots in China are classified in five grades, from A to AAAAA (best), and have at least one planning document. Integrated planning plays an important role in directing and controlling touristic sites to guarantee their sustainable development. Appropriate planning positions the nature, function, and product of the tourist

Hainan Wanjia Orchard. A. Brochure. B. Tasting fruits for free.



Mulberry Orchard in Suzhou.

Red Bayberry Orchard beside Taihu Lake in Wuxi.

orchard and includes transportation systems and facilities based on tourists' expectations.

Careful Construction

The tourist orchard must be constructed under high quality standards. The core point of this idea lies in *"focus on the person, focus on expectations."* It is essential, for example, that

Annual selection of fruits held by local government.

modern restroom facilities be constructed.

Management Renovation

It's necessary for tourist orchards to adopt advanced management systems. The model of farmers managing a production orchard by themselves is useless for a tourist orchard. Employing tourism specialists and managing the enterprise from the perspective of the tourism industry are the key points for the tourist orchard model. The reason for the popularity of the tourist orchard lies in the concept of active, hands-on involvement. Visitors should experience activities such as planting, pruning, grafting, in addition to harvesting fruits in order to feel fully engaged in agriculture production activities, which is now a very different experience from their urban life. Managers must understand this desire of tourists, and arrange opportunities for them to experience and fulfill different production tasks.

Systematic Marketing

Tourist orchards must systematize marketing activities and marketing positioning. For example, names and slogans must be designed in the planning stage and maintained in the operating stage. Influence can be expanded through festivals. For example, Beijing has held three festivals in 2003, 2004, and 2005, on three themes: "Harvest Autumn," "Flower in Spring and Fruit in Autumn," and "Welcome Olympic, Recommendation of Famous and Delicious Fruit in Beijing." Beijing has successfully organized millions of citizens to join in orchard harvests.

SIX USEFUL MODELS

Traditional

The traditional management model for tourist orchards involves only harvesting fruit in the orchard. Currently most Chinese orchards belong to this category.

Rural Landscape Style (Citizens' Orchard)

This style combines the tourist orchard with a village setting. Through elaborate planning the tourist orchard develops rural scenery striving for a pleasing impression. This style attempts to fulfill psychological enjoyment of tourists during the travel process. The Qingqing tourist orchard in Shenzhen belongs to this category. Because this type of orchard is specialized for city residents, it is also called a "citizen orchard."

Theme Park Style

The most distinct characteristic of a theme park style is the development of a series of thematic activities depending on products and services. For example, tourist orchards could highlight juicing machinery, brewing and fermenting

Grape promotion.

operations, and fruit science education. The tourist orchard in a theme park style located on an island in the Yangtze River in Nanjing specializes in grape culture, wine production, and tasting activities of fruit and wine.

Eco-recreation Style

This style tries to create a wonderful natural environment by planting trees in a natural way, similar to that found in an arboretum. A series of facilities will be set up in these orchards so that tourists could enjoy leisure activities in a well-protected eco-environment.

Tech-education Style

This style is also referred to as an experimental orchard. The major function lies at cultivating and planting excellent fruit trees, and at the same time exhibiting the new technology in

Orange orchard in Wuxi.

Tourists picking mango.

pomology in order to educate tourists. This involves research facilities and demonstration plots.

Comprehensive Recreation Style

This style of orchard is designed from the perspective of tourists combining orchard and related leisure activities. This style, which involves extensive facilities, combines travel and relaxation.

THE PROSPECT OF TOURIST ORCHARDS IN CHINA

With the growth of income and increased time for recreation in China, people desire diversity and uniqueness of recreational activities. The tourist orchard concept combines modern agriculture with tourism. Tourist orchards can attract massive amounts of visitors based on their infrastructures, management, and human services. We expect the development of tourist orchards to become more standardized but there are opportunities for unique kinds of development. Tourist orchards can also promote the development of the local economy as well as the income of local farmers. We anticipate that tourist orchards could be a highlight in the tourism industry of China.

Further Reading

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Onion as a Nutraceutical and Functional Food

Yves Desjardins

It is no secret that the way you live affects how long you will. A recent study from the Cambridge Institute of Public Health found that those people who exercise regularly, do not smoke, drink alcohol moderately, and eat at least five portions of fruits and vegetables (FAV) a day live an average of 14 years longer than those who adopt none of these behaviours (Khaw et al., 2007). The same team in the *Epic-Norfolk Prospective Study* had previously reported that high fruit and vegetable intake was a good indicator for lower mortality risk from all causes in both men and women (Khaw et al., 2001). These types of scientific results have certainly been instrumental in the recommendation of FAO/WHO to consume more fruits and vegetables to reduce the incidence of chronic diseases: men and women should respectively consume at least 800 and 400 grams of FAV daily to reduce the burden of diseases like diabetes, cardiovascular diseases, obesity, and even cancer (WHO Technical Report Series 916, 2003).

Conscious of the pivotal role of FAV in the diet and the ever increasing evidences linking phytochemicals to the prevention and cure of many diseases, the Board of ISHS created a new Commission entitled "Fruits and Vegetables and Health" to create bridges between horticultural sciences and the fields of nutrition and medical sciences. The idea was to open a discussion stream with these disciplines and let horticultural sciences be recognized as an important player in the creation and supply of FAV with improved health benefits. Here, we discuss the health benefits of consuming onions with emphasis on their polyphenols and sulphur compounds. This brief review highlights some of the latest and most significant information on the health effect of this ubiquitous vegetable (Block, 2005; Madhujith and Shahidi, 2004; Nemeth and Piskula, 2007; Griffiths et al., 2002) and explores new ways this commodity could be utilized to improve health.

Fruits and vegetables contain vitamins, minerals, carotenoids, and organic acids, which contribute to their health effects, but they also contain a variety of polyphenols, which are increasingly regarded as protective agents against chronic diseases (Liu, 2003). Polyphenol intake differs among countries and different cultures. According to some authors, the daily polyphenol consumption can reach up to 1000 mg (Aherne and O'Brien, 2002). The most important sources of polyphenol in the diet are flavonol-type flavonoids like quercetin, myricetin and kaempferol (Hertog et al., 1995). Among the different sources of dietary polyphenol consumed by the population worldwide onion is considered one of the most important (Hollman and Arts, 2000; Nemeth and Piskula, 2007). One should thus expect onions to be responsible for many of the benefits of FAV on human health, even more so since they also contain sulphur compounds that provide health benefits of their own.

ONION PHYTOCHEMICALS

Onions and allied alliums are among the most produced vegetables worldwide, just after watermelon and tomato (FAOStat, 2006) (Fig. 1). Produced worldwide, they are consumed by almost all cultures as a staple food (Table 2). Onions are one of the most ancient cultivated plants and were well known in pharaonic Egypt, 7000 years ago (Brewster, 1994). Ancient wisdom recognized some of the unique health properties conferred by the plant. For instance, onions were long used for preventing infections in wounds and were so used until the modern discovery of antibiotics. Further, the distinct volatiles produced by many members of the species and their acrid effect on lachrymal glands was also considered to provide health benefits as well as being a major flavour component of the food.

> *"To the onion, as to the skunk, nature awarded a supremely effective defence mechanism: a pungent odour that can scare away the toughest of hunters."*
>
> *"The lachrymators, when cooked, turns sweet - fifty times sweeter, in fact, than refined sugar. Because humans crave their sweets, they have braved onion's defences for millennia, making up in taste what they have paid in tears"... ." (McNamee, 2006)*

Onions are an excellent source of many beneficial nutritional compounds (Fig. 2). They provide minerals, fibres, vitamins and are a rich source of polysaccharides and polyphenols. More specifically, onions are rich in two chemical classes known to have benefits to human health: sul-

Figure 1. Area (million ha) under production in the world.

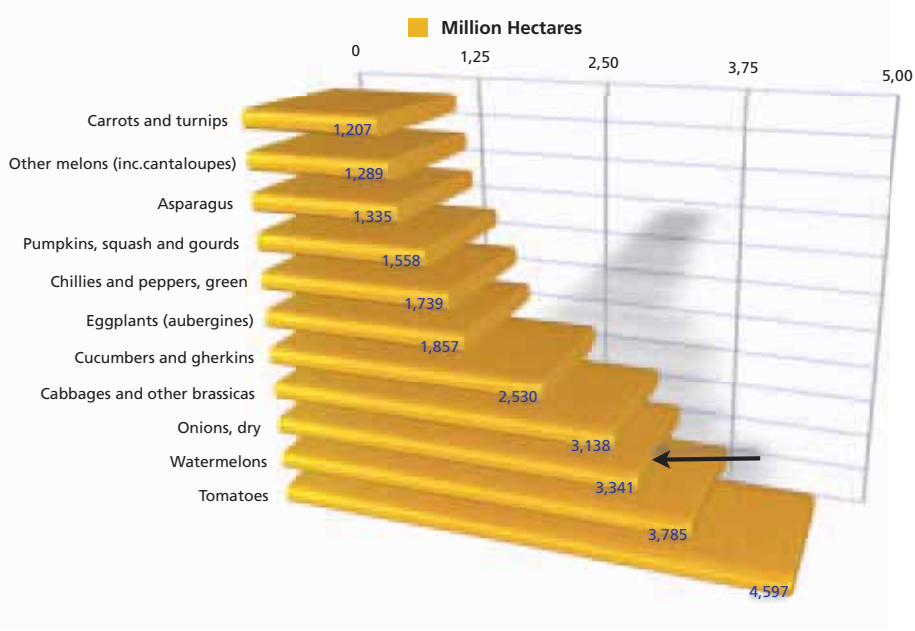


Table 1. Quercetin content among some food and beverages (Nemeth and Piskula, 2007). Green tea and red wine are expressed in mg/L.

Crop	Quercetin content (mg/kg FW)
Red onions	1000
Kale	450
Yellow onions	347
Cherry tomatoes	63
Black current	37
Apples	36
Broccoli	30
Green tea	25
Green beans	16
Red wine	8

phur containing alk-(en)-yl-cysteine sulphoxides (CSO) and more specifically S-prop-1-enyl-cysteine sulphoxide (PeCSO) and flavonoids.

Sulphur Containing Compounds

Sulphur containing compounds are integral part of *Allium* metabolism and they provide the characteristic flavour and odour of onion. Cysteine sulphoxides in some *Alliums* represent close to 1% of their fresh weight (Kubec et al., 2000). According to Lancaster and Kelly (1983), non-protein cysteine and glutathione and their derivatives account for almost 5% of the plant's dry weight. As for glucosinolates in *Brassicas*, sulphur compounds in *Alliums* are believed to participate in defense protection against pathogens and herbivores (Brewster, 1994). They play a crucial role in many central metabolisms like sulphur assimilation by plants, redox homeostasis and xenobiotic detoxification (Noctor et al., 1998). The biosynthesis of sulphur compounds in *Alliums* is complex due to the large variety of chemicals involved (Fig. 3). Thorough reviews on the biosynthesis of these compounds have recently been published by Jones et al. (2004) and by Rose et al. (2005). Four major non-volatile cysteine sulphoxides are the precursors of the volatile compounds found in *Allium*. The first and most ubiquitous is S-allyl-cysteine sulphoxide (ACSO) (Alliin) found in garlic; S-methyl cysteine sulphoxide (MCSO) (Methiin) found in *Alliums* and some *Brassicaceae*; S-trans-prop-1-enyl cysteine sulphoxide (PeCSO) (Isoalliin) found in onions; and S-propyl cysteine sulphoxide (PCSO) (Propiin) also found in onions. Apart from these main cysteine sulphoxides, several γ-glutamyl peptides (γGP) derivatives of CSO have also been characterized (Jones et al., 2004).

Figure 2. Onion and onion by-products bioactive phytochemicals content.

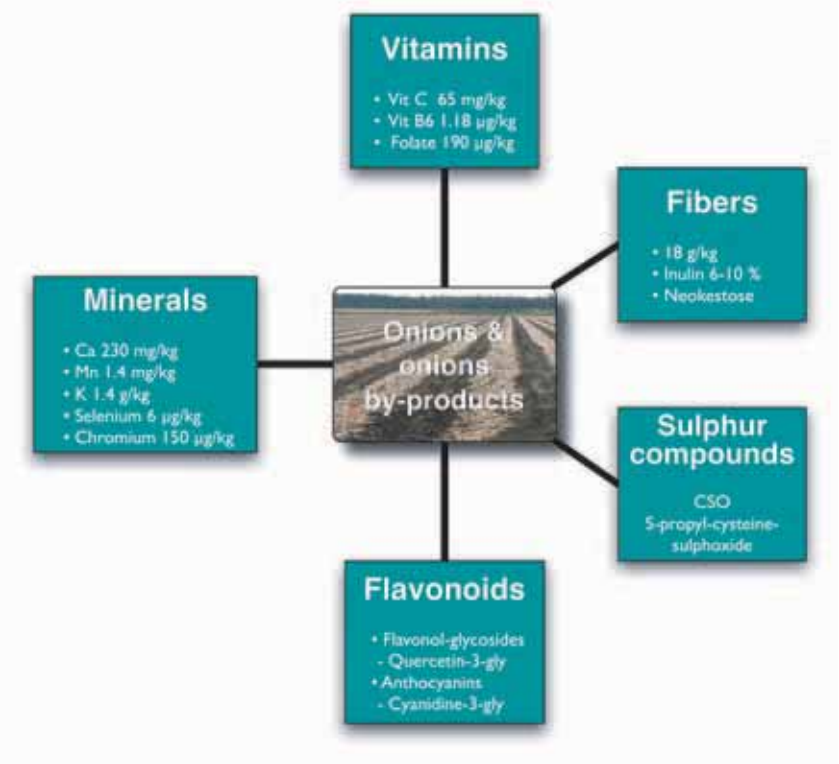


Table 2. Principal onion producing countries in 2006 (FAOStat).

Countries	Production (million tonnes)	Area (million ha)	Yield (t/ha)
China	19.6	0.95	20.6
India	6.4	0.55	11.7
USA	3.3	0.065	51.2
Pakistan	2.1	0.149	13.8
Russian Fed.	1.8	0.12	14.6
Turkey	1.8	0.08	22.0
Iran	1.7	0.05	33.7
Egypt	1.3	0.04	30.5
Brazil	1.2	0.057	20.5
World	61.6	3.34	18.7
Europe	8.4	0.415	20.1
Asia	38.8	2.311	16.8
Americas	7.7	0.286	30.4
Africa	5.4	0.320	16.9

The predominant biosynthesis pathway for these molecules found in *Alliums* proceeds via an S-alk(en)ylation of glutathione, followed by decarboxylation, oxidation and transpeptidation to yield cysteine sulphoxides. Another route, important for the synthesis of (+)-S-propyl-L-cysteine sulphoxide bypasses glutathione altogether and follows a more direct route of thioalk(en)ylation of O-acetyl serine by a propanethiol to give S-propyl cysteine, followed by an oxidation to give a cysteine sulphoxide (Fig. 3).

The volatile sulphur compounds are generated through the action of alliinase (E.C. 4.4.1.4, S-2-alk(en)yl-L-cysteine sulphoxide lyase) on non-volatile precursors. This enzyme catalyses the beta elimination of the S-2-alk(en)yl sulphoxide group from the different cysteine sulphoxide molecules in presence of the cofactor pyridoxal 5'-phosphate to produce pyruvate, ammonia and sulfenic acids. As for glucosinolates, the enzyme is stored in a different cellular compartment (vacuole) from its substrate (cytoplasm) and will generate the highly reactive sulfenic acids upon disruption of the cellular integrity. Sulfenic acids will condense spontaneously and inter-react to form many different thiosulfinates, a class of highly volatile and strong smelling compounds characteristic to most *Allium* species. More than 80 volatile compounds of this class have been identified in the headspace of fresh or cooked alliums (Brewster, 1994) some of which possess beneficial effects on health. The kinetics of cysteine sulphoxide hydrolysis and the reactivity of the initial sulfenic acid generated influence the type of thiosulfinates formed, hence the difference in flavour of fresh, boiled or fried onions.

Flavonoids

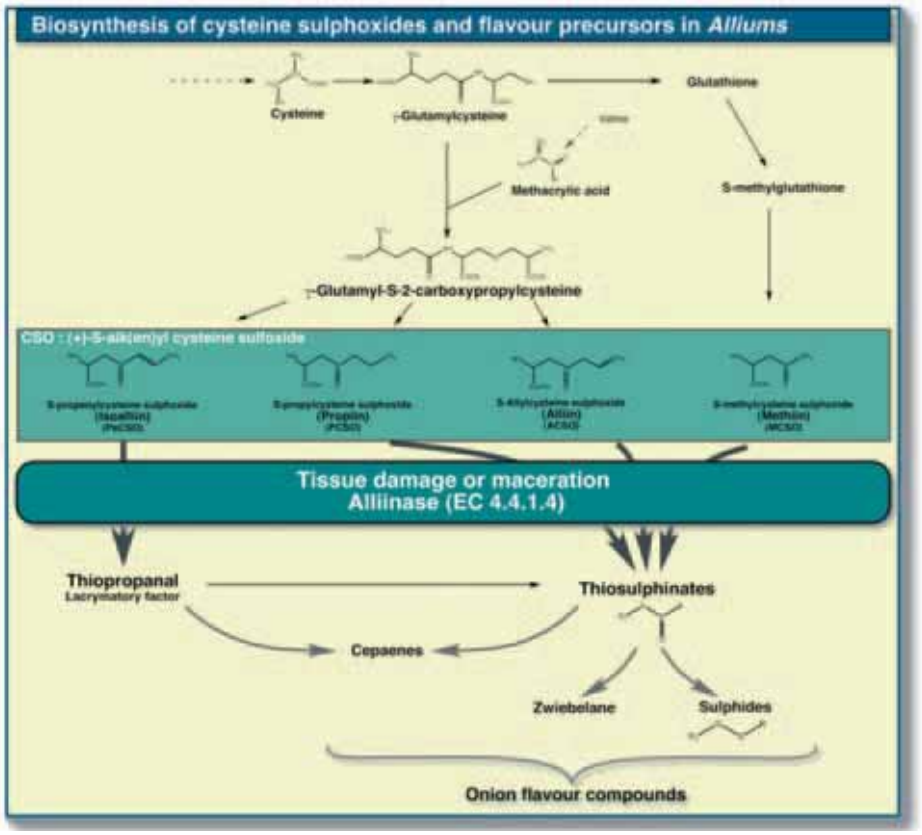
Two types of flavonoids are found in the bulb: anthocyanins in red onions and flavonols like quercetin and kaempferol in most yellow flesh cultivars. In dried red onion, among the sixteen glycosylated and aglycone forms of flavonols identified (Fossen et al., 1998), quercetin is the main flavonol present in the outer layers of the skin (Bilyk et al., 1984) (Table 1) at concentrations reaching up to 2.1% w/w . Different cyanidin glycosides are also found in red onion (Donner et al., 1997).

Minerals

Onion is an excellent source of Ca, K and Mn providing up to 10% of the daily requirements of these elements. It can also accumulate Se if grown in Se-rich soils in the form of selenocysteine and seleno-proteins. This element participates in oxido-reduction reactions and contributes to the antioxidant capacity of the plants (Terry et al., 2000). Interestingly, onions also contain chromium and are considered a good source of this element. Chromium has been recently linked to diabetes prevention and appears to act as such by potentiating insulin receptor kinases (Wang et al., 2005) and to be a part of the glucose tolerance factor, involved in cellular responses to insulin. Clinical studies on diabetic patients have shown that chromium can decrease fasting glucose levels, improve glucose tolerance, lower insulin levels and decrease total cholesterol and triglyceride levels. Two hundred grams of onions contain up to 20% of the daily requirements in this element.

Regular consumption of onion soup can reduce the risk of cardiovascular diseases (Hubbard et al., 2006a).

Figure 3. Biosynthesis of cysteine sulphoxides and onion flavour compounds.



Polysaccharides

Onions finally contain large quantity of non-structural carbohydrates (65% of dry weight) in the form of inulin fructans, a fructose polymer with significant prebiotic properties (Biedrzycka and Bielecka, 2004).

HEALTH BENEFITS

Traditional wisdom and scientific literature (over 3000 publications) have confirmed the health benefits of onion and garlic (Amagase et al., 2001). These benefits include reduction of risk factors for cardiovascular diseases (Ali et al., 2000; Milner, 2001; Bazzano et al., 2002), reduction in cancer incidence (Fleischauer and Arab, 2001), reduction of inflammatory response (Srivastava, 1986; Kim et al., 2001), enhanced xenobiotic detoxification (Munday et al., 2003), antidiabetic (Srinivasan, 2005) and antioxidant properties (Prasad et al., 1995), antibiotic (Sivam, 2001) and antifungal properties (Lancaster and Kelly, 1983; Rose et al., 2005), etc.

Cancer Prevention

Many prospective and epidemiological studies have shown that the regular consumption of *Alliums* could have protective effects against cancer (Lampe, 1999). For instance, there appears to be a strong link between the consumption of onions and the reduced incidence of stomach and intestine cancers (You et al., 2005). Epidemiological studies also show correlation between the consumption of onions and a reduced incidence of cancers (Griffiths et al., 2002). A synthesis of case-control studies carried in Italy and Switzerland reveals that consumption of one to seven portions of onions per week reduces the risks of colon, ovary, larynx and mouth cancers (Galeone et al., 2006). Similar correlations are also observed for brain and stomach cancers in a case-control study in China (Hu et al., 1999). Dutch researchers have shown an inverse relationship between onion consumption and the incidence of stomach cancers (Dorant et al., 1996). Mortality due to prostate cancer also appears to be reduced by a diet making a large place for onions (Grant, 2004). The risk of breast cancer was shown to decrease as consumption of *Alliums* was increased in a French case-control study (Challier et al., 1998). The Epic Prospective Study, conducted on more than half a million subjects, shows clear correlation between onion consumption and reduction in intestinal and stomach cancers (Gonzalez and Riboli, 2006), but similar correlations could not be established for lung, prostate, nor breast cancer and onion consumption. These observational studies must however be interpreted with caution since they do not take into consideration other important factors like the variety, the mode of cooking, and the total quantities consumed by the subjects. This may explain why

other studies have been inconclusive; e.g. no protective effect demonstrated in a large cohort study in the Netherlands (Dorant et al., 1995).

Onions probably act at different stages of the aetiology of cancers (Sengupta et al., 2004). Some studies say that onion extracts can inhibit the mutation process (Shon et al., 2004) and reduce the proliferation of cancer cells (Yang et al., 2004). This effect is being attributed to quercetin in particular.

Cardiovascular Diseases

Onions contain a number of bioactive molecules that can presumably reduce the risks for cardiovascular diseases (Osmont et al., 2003). Apart from a few studies on humans, the vast majority of studies have been conducted in vitro on animals. All in all, this vegetable is mostly known for its capacity to reduce platelet aggregation in vitro (Ali et al., 2000). This aggregation of platelets in the blood increases the risks of thrombosis and, as a consequence, the risk of cardiac attack. A recent study on pigs reveals that feeding raw onions for six weeks did not have an impact on platelet aggregation but caused a significant reduction in blood triglycerides, another biomarker of cardiovascular diseases (Gabler and Osrowska, 2003). The quantity fed to the animals was equivalent to the daily consumption of one onion by a human. A preliminary study conducted this time on humans showed that the consumption of the equivalent of three onions in a soup was sufficient to significantly reduce the blood platelet aggregation (Hubbard et al., 2006b). This activity appears to be less important after cooking (Janssen et al., 1998) and more important in pungent onions (Osmont et al., 2003). It is attributed to quercetin and alkyl-propenyl cysteine sulphoxyde molecules, but the exact mode of action remains elusive. It is suggested that these compounds stimulate the release of arachidonic acid from membrane phospholipids, which initiates eicosanoid metabolism in mammals leading to the inhibition of thromboxane A synthesis and a significant reduction in platelet aggregation and vasoconstriction (Moon et al., 2000).

Antidiabetic

Owing to the presence of prebiotic polysaccharides (inulin), which are poorly degraded by the gut enzymes, and the presence of flavonoids, onions have been shown to possess antidiabetic potential (Srinivasan, 2005). Sharma et al. (1977) showed that onions had antihyperglycemic effects. Such effects were confirmed by Tjokroprawiro et al. (1983) who conducted a crossover comparative study with twenty diabetic patients to assess the effect of a diet comprising onions and green beans on serum glucose levels. They showed that the consumption of 20 g fresh onion three times daily significantly reduced blood sugar levels.

Onions and their allies are a great source of phytochemicals with beneficial health effects.

Asthma

Compounds found in onions (thiosulfinates) appear to have antiasthmatic properties. This anti-inflammation activity is mediated through a suppression of cyclooxygenase reaction cascades, initiating once again the eicosanoid metabolism, leading to bronchial restriction (Wagner et al., 1990). Onions contain cepaenes that are best known for their inhibition of pro-inflammatory messengers like arachidonic acid.

Antibiosis

Onions and garlic extracts have been shown to inhibit growth of more than 80 species of plant pathogenic fungi (Fenwick and Hanley, 1985). They also manifest the same kind of antibiosis against many bacteria affecting humans. Sulphur compounds of onions apparently bind to -SH groups of essential microbial enzymes (trypsin and proteases) leading to an inhibition of their growth (Yin and Tsao, 1999). Aqueous extracts of onions were shown to be active against several gram-negative bacteria (Zohri et al., 1995). Moreover, onion extracts inhibit oral bacteria and may thus reduce the incidence of cavities (Kim, 1997). According to Kyung and Lee (2001), PeCSO is the compound involved in the inhibition of microbial metabolism.

Prebiotic Effects

As previously discussed, onions are a rich source of dietary fibers and especially of inulin, a polyfructosan. The health benefits of inulin-type fructans to human health have now been studied for more than a decade (Ritsema and Smeekens, 2003). It has prebiotic properties as it is preferably fermented by beneficial bowel bacteria like *Lactobacilli* and *Bifidobacteria*, thereby altering the bacterial mycoflora of the intestine in such a way that pathogenic, or harmful bacteria become less abundant (Kruse et al., 1999). Neokestose, another fructan found in onion, has recently been shown to be an excellent promoter of the growth of beneficial bacteria (Kilian et al., 2002). Fructans also promote the absorption of calcium and could thus be useful in the prevention of osteoporosis (Scholz-Ahrens et al., 2001). High fructan diets have also been shown to lower concentration of cholesterol, tryacylglycerol, phospholipids, glucose and insulin in the blood of middle-aged men and women (Jackson et al., 1999).

NEW OPPORTUNITIES FOR ONION PHYTOCHEMICALS

In addition to the beneficial health effects of onions, new opportunities are arising for the valorisation of its by-products in the food and health arena. The onion industry generates large quantities of wastes, which can reach up to 15% of the overall crop (Roldan et al., 2008). For Europe and North America combined, this is close to 2 million tons of onion culls going to the landfill yearly. This constitutes a huge spoilage of valuable phytochemicals and bioactive ingredients awaiting valorisation. These wastes, if processed properly and stabilized accordingly, could be utilized by the food and cosmetic industry as functional ingredients (Roldan et al., 2008).

For example, the onion by-products could be used to fortify normal food or juices in bioactive molecules or be used by the food indus-

try as a source of natural antioxidants. An example of the former possibility is the "functionalization" of tomato juice enriched in vegetable by-products providing increased antioxidant capacity and better consumer's acceptance (Larrosa et al., 2002). Natural antioxidants found in onions could help solve one of the most important problems plaguing the food and beverage industry, namely the enzymatic browning leading to quality loss and off-flavours (McEvily et al., 1992). This rational use of onion antioxidants answers a concern of the public seeking to substitute synthetic antioxidants by natural ones (Jang et al., 2002), as they become aware of the risks associated with synthetic chemicals and particularly with sulphite-containing antibrowning agents. The increased scrutiny of regulatory agencies is also creating a need for natural substitutes for synthetic antioxidants, thus opening a market niche for onion-based antioxidants. To this effect, flavonoids and thiol-antioxidants have been shown to prevent oxidative browning and inhibit polyphenol oxidases in a number of commodities: pears (Kim et al., 2005), potatoes (Lee et al., 2002), bananas (Lee, 2007), apple juice (Eissa et al., 2006) and apple slices (Hosada and Iwahashi, 2002).

Another promising use for onion wastes and onion polyphenol extracts is their inclusion in meat and fried foods. The rationale behind this suggestion is that natural antioxidants found in onions could inhibit lipid oxidation and the production of advanced glycation products during meat cooking. For example, methanolic extracts of rice hulls inhibited lipid oxidation of ground beef as measured by thiobartituric acid reactive substances (TBARS) (Asamarai et al., 1996). Similarly, Tang et al. (2001) showed that tea catechins were more efficient than α-tocopherol in inhibiting muscle lipid oxidation in fresh red meat, poultry and fish. Adding 1 or 2% grape seeds extract effectively inhibited TBARS generation in poultry meat patties (Lau and King, 2003).

Antioxidants isolated from onion could also be used to prevent lipid oxidation in the gastrointestinal tract and prevent formation of harmful and even cancerous oxidation end products like malonaldehyde (MDA). This suggestion was recently made by Kanner's group in Israel (Gorelick et al., 2007) who demonstrated that the addition of quercetin to red turkey meat inhibited the production of MDA during cooking and prevented MDA generation during digestion. Their results add weight to the idea that the gastrointestinal tract is the location of the protective activity of antioxidants (Halliwell et al., 2000). High-fat, high cholesterol food containing oxidized products can affect endogenous lipoprotein production and catabolism and lead to transient exposure of arteries to cytotoxic, oxidation end products. The increased excretion of MDA in the urine after ingestion of oxidized fat exemplifies this phenomenon and may explain why populations on red-meat, high fat diets are prone to the development of atherosclerosis and cancer (Norat and Riboli, 2001).

CONCLUSIONS

Onions are a staple in the human diet for obvious reasons. In addition to providing flavour to food, onions contain considerable amounts of phytochemicals conferring many benefits to health. Their antioxidant scavenging free radicals are associated with reduced risks of cancer and cardiovascular diseases. *Allium cepa* L. also has antimicrobial, antispasmodic, anti-cholesterolaemic, hypotensive, hypoglycaemic, and anti-asthmatic properties. To this effect, it constitutes one of the major unique sources of polyphenols in the diet and certainly accounts for the beneficial effect of FAV on health.

Apart from promoting the consumption of onions to benefit from their therapeutic properties, the onion industry has the potential to find new "functional" uses for by-products and extracts in the food and cosmetic industry. Although, more human clinical trials are needed to unequivocally demonstrate the health benefits of onion constituents, based on epidemiological evidence to date, we should encourage the consumption of *Alliums* as a preventative method to reduce the incidence of many diseases.

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Floricultural Boom in India

R.K. Roy

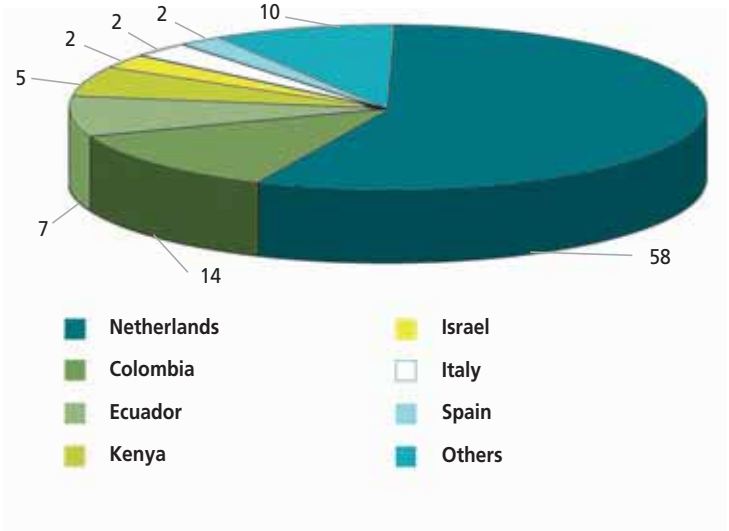
In 2004-2005, the total horticultural sector of India contributed about 28% of the annual gross domestic product (GDP) of agriculture from about 13% of the area and 37% of total exports of agricultural commodities. India is fast becoming a strong centre of floriculture in the global scene. During the last 5-7 years, there was a complete surge in the floricultural activity from production of flowers (cut and loose), ornamental plants (potted and cut-greens), dry flowers (value-added products), and marketing.

India is bestowed with a wide variety of agro-climatic conditions suitable for growing all kind of flowers and ornamental plants. High rise hills to vast coastal areas together with the fertile Indo-Gangetic plains provide a unique combination of climate and soil, the envy of many countries. India has been designated as one of the 12 mega-diversity states of the world. The flora of the Indian sub-continent is very rich in diversity with many endemic species, largely due to its varied agro-climatic conditions. Ten bio-geographic zones, namely Trans-Himalayan, Himalayan, North-east India, Indian Desert, Semiarid Zone, Indo-Gangetic Plain, Western Ghats, Deccan Peninsula, Coastal Zone and Islands, depict diversity of climate and flora. Each zone has its own unique and characteristic natural vegetation (Rodgers and Panwar, 1988). Some of the zones like the northeast (Assam, Arunachal Pradesh, Meghalaya, Sikkim) harbor only a few indigenous economically important ornamentals such as orchids, zingibers, and *Nepenthes*. Although *Heliconia* and *Anthurium* are not native to India, they are grown abundantly in southern states (Kerala, Tamil Nadu). Due to congenial agro-climatic conditions, an enormous opportunity exists throughout India for cultivation of various flowers and ornamental plants on a commercial scale.

India's present contribution to the global floricultural export market is negligible (about 0.4%) as compared to the Netherlands (58%), Colombia (14%), Ecuador (7%), Kenya (5%), Israel (2%), Italy (2%) and Spain (2%) (Fig. 1).

Heliconia **(from Kerala).**

Figure 1. India's contribution to the global floricultural export market compared to the Netherlands, Colombia, Ecuador, Kenya, Israel, Italy and Spain.



However, it is conceivable that in just a few years India could challenge the leading growers / exporters by virtue of well planned policies formulated by the Government of India backed with international technologies for greenhouse production.

HISTORY OF FLOWER CULTURE

Use of flowers in the social life of India has a long tradition. The origin of flower and ornamental plant growing is contemporary with agricultural crops. In the beginning their use was exclusively for esthetic and religious purposes (Singh, 2002). References regarding the use of flowers during ancient time exist in the old Hindu classics such as *Veda, Puran* and *Ramayana*. Many paintings and carvings on the walls of old structures provide enough evidences that flowers were an integral part of daily life and adornment (Randhawa, 1976). Motivation for cultivating flowers arose due to their extensive use for religious purposes, particularly for worship. In India, Gods and Goddesses are worshiped with particular kind of flowers such as the Goddess 'Kali' with hibiscus, Goddess 'Durga' with lotus and Lord Shiva with datura, now naturalized throughout India. Moreover, a large number of festivals and rituals are celebrated, using flowers in various ways. Such usages along with the steady increase of population virtually have created huge domestic demand for these so that floriculture has become an increasingly important industry in India (Dadlani, 1999).

Table 1. Area and production of loose flowers in different states of India (2004-05). Source: 11th Five Year Plan Document, Govt. of India.

State/Union Territory	Area (ha)	Production (000 tonnes)
Tamil Nadu	23,233	1,87,342
Karnataka	18,458	1,45,890
Andhra Pradesh	13,909	57,875
West Bengal	17,925	44,674
Maharashtra	8,660	51,705
Delhi	4,490	25,007
Haryana	4,810	55,583
Uttar Pradesh	7,968	11,905
Gujarat	6,956	41,811
Himachal Pradesh	407	2,243
Punjab	615	3,075
Rajasthan	3,312	2,604
Madhya Pradesh	1,829	1,097
Bihar	103	1,757
Uttarakhand	525	558
Jammu & Kashmir	226	922
Manipur	535	701
Others	9,2323	64,142
Total	**1,15,921**	**6,54,837**

COMMERCIAL FLOWERS

The large number of flowers commercially grown in India is generally of two types: loose flowers and cut-flowers with stems. Both these types are grown mainly under open field conditions and partly under a protected environment. India is the largest producer of flowers after China (Table 1). The area under floriculture production has grown significantly over the last 20 years and the present production on 115,921 ha exceeds 654,837 tonnes of loose flowers being annual production. The domestic floricultural business comprising of loose flowers (rose, chrysanthemum, jasmine, marigold, crossandra, hibiscus, tuberose, sunflower) is increasing at a rate of 7-10% per annum with an estimated value of Rs.10 billion in 2006-2007 (58 rupees

Floral work by marigold flowers in a temple, Lucknow.

Flower shop outside a temple, Lucknow.

An excellent display of marigold flowers (models of different vegetables)

Floral arrangement of gladioli cut-flowers.

= 1 euro). The leading states are Tamil Nadu, Karnataka, Andhra Pradesh, West Bengal, Maharashtra, Haryana, Uttar Pradesh and Delhi having nearly 77% of area under floricultural crops. Similarly, production of cut-flowers with stems reached to 1,952 million stems in 2007. Major cut-flower producing states include West Bengal, Karnataka, Uttar Pradesh, Maharashtra, Gujrat, Himachal Pradesh and Uttarakhand (Table 2). About 95% of the flowers is grown under open field conditions with barely 1.5% under greenhouse. Altogether, there are only 100 large greenhouses: New Delhi (50 ha), Bangalore (200 ha) and Maharashtra (35 ha). Most of the important commercial floricultural crops as well as many minor ones are not indigenous to India (exceptions are jasmine, hibiscus, lotus, gomphrena and crossandra).

Table 2. Production of cut-flowers in different states of India (2004-05). Source: Indian Horticulture (Singh and Upadhyaya, 2007).

State/Union Territory	Cut-flowers (000,000)
West Bengal	8,963
Karnataka	4,134
Uttar Pradesh	3,572
Gujarat	1,969
Haryana	508
Himachal Pradesh	182
Jammu & Kashmir	110
Andhra Pradesh	71
Sikkim	28
Orissa	12
Bihar	11
Mizoram	1
Total	**19,515**

Anthurium

Commercially important anthuriums consist of two groups: flowering types (*A. andreanum* / *A. scherzerianum*) and foliage types (*A. clarinervium* / *A. crystallinum*). The flowering group with unusual colored spathe in different color combinations is much in demand in the floricultural trade. Kerala, Karnataka, Tamil Nadu and northeastern states have congenial agro-climatic conditions. However, commercial production has not met the internal demand resulting in high imports.

Anthuriums [from Kerala on display, Hort. Expo., 2007, New Delhi].

Chrysanthemum

Though chrysanthemum is an important cut-flower in international trade, commercial cultivation in India is not popular. The states of Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu have been growing small quantities of chrysanthemum as a cut-flower. *Chrysanthemum morifolium* is also very popular as a garden plant and has high demand in the nursery trade. The crop is mainly grown in open field condition and flowers are available during winter season (November - February). However, large scale commercial cultivation for the production of cut-flowers is yet to pick up. Research and development of new cultivars and culture is being carried out in the National Botanical Research Institute (NBRI), Lucknow; Indian Agricultural Research Institute (IARI), New Delhi and Indian Institute of Horticultural Research (IIHR), Bangalore.

Chrysanthemum in a polyhouse.

Gerbera

Cut-blooms of different cultivars of *Gerbera jamesonii* (semi-double / double) are in high demand in the domestic market but are in short supply. Presently, gerberas are grown in the polyhouses but production needs to be extended in both protected and open filed culture.

Gladiolus

Gladiolus x *hybridus* is a popular floricultural crop in India grown mainly for cut-flowers. Because of the variation in flower color and suitability for open cultivation, gladiolus is one of the important floricultural crops and is used for vase decoration and making bouquets. There are about 2000 ha in the northern states (Uttar Pradesh, Uttarakhand, Himachal Pradesh and parts of Punjab and Haryana) and the cultivars 'Aldebaran', 'Friendship Pink', 'Novalux', 'Oscar', 'Red Beauty', 'Sylvia', 'Tropic Sea' and 'White Prosperity' predominate. Many cultivars have been developed by the NBRI, Lucknow; IARI, New Delhi; IIHR, Bangalore and agricultural universities. The domestic market is the main source of consumption although export has been initiated recently in Gulf countries. Under the National Horticultural Mission, gladiolus is one of the crops being emphasized for increased planting.

Jasmine

In India jasmines are mainly cultivated for the production of loose flowers in the eastern and southern states. Flowers are used in the form of

Ladies making garland of jasmine, crossandra, chrysanthemum, aster and foliage.

garland in various ways. The area under cultivation is estimated to be 1,000-1,200 ha. *Jasminum sambac* and *J. auriculatum* are grown commercially for flowers but essential oil (concrete) is also an important commercial product.

Marigold

Marigold (*T. erecta* and *T. patula*), although native to the New World, is the most popular and extensively used flower in India due to its many uses, continued availability and low cost of production in open field. Locally known as *genda*, the flower is used in worship and decoration, in the form of *"lari"* (loose flowers stitched by a thread) during social functions / ceremonies resulting in huge domestic demand. As the crop can be grown in different seasons without much difficulty, there is continued supply in the market. Karnataka, Tamil Nadu, Maharashtra, West Bengal and Haryana are the leading states; estimated crop area is 10,000 ha.

Orchid

The northeastern states (Assam, Arunachal Pradesh, Meghalaya and Sikkim) are the natural habitat of hundreds of orchid types. However, commercial cultivation for the production of cut-flowers or potted plants is very limited at present. Private entrepreneurs have started large scale micropropagation mainly for export of plantlets. The internal demand of cut-flowers is met by import. *Cattleya, Cymbidium, Dendrobium, Phalaenopsis* and *Vanda* are the commercially important genera marketed in India.

Rose

Rose is cultivated under open conditions for the production of loose flowers that are used for domestic consumption for various purposes. Flowers with stem are in high demand but are not produced abundantly. In recent years greenhouse cultivation has been initiated. Export oriented units for the production of quality cut-flowers supported with Dutch and Israeli technology have been set up in Maharashtra (Pune, Nasik), Karnataka (Bangalore) and Ghaziabad (Uttar Pradesh).

Orchid cut-flowers (from Sikkim).

Tuberose

In tropical countries such as India, there is limited availability of flowers during the summer months (May to August). The demand of both loose and cut-flowers is steady but cannot be met with open-field production. Tuberose (*Polianthes tuberosa*), queen of the summer, with its fragrance is a popular species. Loose florets are used in the form of garland, while cut-spikes are used for preparation of bouquets. Commercial cultivars include single flowered types ('Calcutta Single', 'Hyderabad Single', 'Prajwal', 'Shringer') and double flowered types ('Calcutta Double', 'Hyderabad Double', 'Suvasini', 'Vaibhav'). Main production is in eastern and southern states (Karnataka, Tamil Nadu, Maharashtra, Assam and West Bengal).

Tuberose (vase arrangement).

Minor Ornamental Crops

Some of the seasonal and perennial flowering plants that have commercial potential for the domestic market include antirrhinum, calendula, crossandra, China aster, gomphrena, gypsophila, hibiscus, lotus, statice, sunflower (small) and zinnia. A few are used as cut-flowers while others as loose flowers.

NATIONAL POLICIES

Horticulture including floriculture in India comes under the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. Under the Ministry, there are different bodies that implement formulated policies on horticulture. Planning at the national level is done by Planning Commission. At State level, there is the Directorate of Horticulture, which oversees implementation of programs taken up for development of horticulture. Research activities for development of new cultivars, standardization of agro-technology suitable for different zones, extension of vase life and development of value added products is considered by the Indian Agricultural Research Institute (IARI), Indian Institute of Horticultural Research (IIHR), state agricultural and horticultural universities and societies.

Five-Year Plan (FYP)

India's future planning for economic growth was initiated by the Parliament of India in 1951

through Five-Year Plans (FYPs) developed, executed and monitored by Planning Commission. FYPs generally allocate budgets in different thrust areas. Currently the 11th FYP is underway from April, 2007-2012. Agriculture was always an important sector but during the first three FYPs the importance of horticulture was neglected until the 4th FYP (1969-1974) when a sum of Rs.34.78 million was allocated for this sector. During the 8th FYP horticulture including floriculture was identified as a thrust area for the development of infrastructure and research and received Rs.1,047 million for its full exploitation. In the current FYP (2007-2012), an allocation of Rs.1,200 million has been made (Banerjee, 2002; http://en.wikipedia.org/wiki/Five-year_plans_of_india / planningcommission.nic.in).

Flower Show, 2007, NBRI, Lucknow.

National Bank for Agriculture and Rural Development (NABARD)

NABARD was set up in 1982 as an apex bank with a mandate for facilitating credit flow for promotion and development of agriculture, small-scale industries, cottage and village industries, handicrafts and other rural crafts. Since its establishment NABARD has been playing an important role in promoting hi-tech horticulture, especially floriculture by providing financial support for development and promotion in different states. The total disbursement of credit to agriculture has reached to Rs.1253 billion for a period of three years from 2004-2005 and the ground level credit flow to agriculture and allied activities reached Rs.1575 billion in 2005-2006. Besides financing floricultural project, NABARD holds meetings at the state and national level with research institutes, organizations and bankers for the strategic development of floriculture by providing model schemes, technical data and research results to progressive farmers and entrepreneurs (Sharma, 2002; www.nabard.org).

National Horticultural Board (NHB)

NHB was set up in 1984 for promoting integrated development in horticulture by way of coordinating, stimulating and sustaining the production and processing of horticultural crops in identified areas. NHB has been pursuing certain objectives for all round development horticulture by setting firms, infrastructures, marketing, training of farmers and other personnel (Negi and Singh, 2002; www.nhb.gov.in).

Agriculture & Processed Food Products Export Development Authority (APEDA)

This export promotion agency came into existence in 1986 under the Ministry of Commerce with a view to maximize foreign exchange earnings through increased agro exports to increase farmer income and create rural employment opportunities. APEDA offers financial assistance under various schemes targeted for export, which covers floriculture and seeds.

Bouquets/floral arrangements for sale in a shop, Kolkata.

In addition, business development in abroad by way of product promotion, publicity, buyer-seller meet etc. are the steps that facilitate export from India (www.apeda.com).

National Horticultural Mission (NHM)

This mission has been launched in 2005 by the Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India as a specially 'Central Sponsored Scheme' to promote holistic growth of the horticulture sector through area based regionally differentiated strategies. In this mission, policy for development of horticulture (flowers, fruits, vegetables) in the state has been formulated as thrust programme by providing subsidy, quality planting material, marketing and training of farmers and district level personnel. Regional agricultural universities and research institutes have been tied up with this mission. The main purpose is to increase production, crop area, post harvest management and to ensure appropriate returns to the growers (Chadha and Choudhary, 2007; www.nhm.nic.in).

Horti-Expos / Agri-Fairs / Flower Shows / Publications

During the last decade, there is tremendous increase in awareness about the importance of ornamental plants and flowers in daily life amongst the common people. This is largely due to an enormous number of flower shows, agri-fairs, horti-expos that are organized by agri-horticultural societies, agricultural universities and research institutes in almost every state. These events provide a unique scope to the general public to know the latest development in the field of floriculture by way of seeing new cultivars and hybrids, improved agro-technologies, processing and packing procedures and value-added products and have far reaching impact on the general public. Publications in the form of newsletters, journals, directories (listing products / firms for export and import, source of elite planting material) further facilitated rapid development of floriculture.

MARKETING

Proper marketing of flowers and other allied products is an important factor that influences success of floricultural business. In India the marketing sector is not well organized both for national and export markets. However, initiatives have been taken up by the Government of India for formation of cooperative societies of farmers, price indexing and publishing and the establishment of auction centers for facilitating marketing.

Domestic

In metropolitan cities like Bangalore, Chennai, Kolkata and Mumbai centralized markets and auction centers provide large scale transaction of fresh flowers. But in small towns, unregulated local assembly markets are the only outlets for marketing. India has a huge and expanding domestic market with steady annual growth of 8-10% due to steep population rise, urbanization and changing life style. Efforts are to be initiated to improve the marketing chain to enable transportation of floricultural products from one region to another. For example, tuberose and jasmine produced in eastern and southern states need to be transported to northern states. Similarly, gladioli, gerbera and roses from the north-west are to be transported to south-eastern states. This would ensure better pricing and remuneration to the farmers and at the

same time reduce the chances of market glut and consequent price fall.

Export

There is substantial increase in the export of flowers and allied products as a result of meticulous planning, research and development. Floricultural exports grew tremendously, from Rs.1.8 billion in 2002-03 to Rs.3.0 billion during 2005-2006. These exports comprised of cut-flowers (to Europe, Japan, USA, Middle East, Australia), loose flowers (to Gulf countries), cut foliage (to Europe), dry flowers (to USA, Europe, Japan, Australia and Russia) and horticultural/floricultural products as per guidelines laid down by Government of India (Singh and Upadhyaya, 2007). If the future planning envisaged in the 11th Five Year Plan (2007-2012) is truly implemented, there will be a quantum jump of floricultural products in the coming years.

FUTURE PROSPECTS

Floriculture is at present a priority and identified thrust area in India. National policies, budgetary allocation, diversification of horticultural products, liberalized imports are clearly an indication that the country is committed to rapid development in the field of horticulture including floriculture. It is a good sign that the choice is also shifting internationally towards tropical flowers such as anthurium, heliconia, amaryllis, lily (Asiatic) and orchid. Therefore, India and other Asian countries are in a position to exploit the prevailing opportunities and take advantage of their varied agro-climate, diverse flora, cheap labor and huge land area. If everything goes correctly and the current floricultural boom continues, India could be a strong player in the field of global floriculture in the coming decade.

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R.K. Roy

AVRDC Appoints New Director General

February 20, 2008 - The World Vegetable Center is pleased to announce the appointment of Dr. Dyno Keatinge as the organization's new Director General. The Center's board members selected Dr. Keatinge by unanimous decision. He will assume his duties as Director General in mid-April.

Dr. Keatinge brings a wealth of experience in international agricultural research and development to the post. He has held senior management positions with the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria and the International Institute of Tropical Agriculture (IITA) in Nigeria. Since 2002 he has served as Deputy Director General - Research at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India.

Dr. Keatinge received his Ph.D in Agronomy/Crop Physiology from Queen's University, Belfast, UK in 1978. From 1993 to 1999, he was Professor of Agricultural Systems and Management at the University of Reading, UK.

Dyno Keatinge

"There's an exciting future ahead for the World Vegetable Center," Dr. Keatinge said. "The Center is poised to make a significant contribution to the Millennium Development Goals over the next decade. Its efforts will be felt by the poor in farming communities throughout sub-Saharan Africa and in other parts of the developing world."

His vision for the Center includes fostering partnerships with organizations of all sizes across the research-to-development continuum, and maintaining a "pro-poor" focus to improve nutrition, food safety and job creation.

Dr. Keatinge replaces outgoing Director General Dr. Thomas A. Lumpkin, who joins the International Maize and Wheat Improvement Center (CIMMYT) in Mexico as new DG.

FAO Launches Photo Contest for Year of Potato

The United Nations is seeking photographers to 'capture the spirit of the spud' as part of a competition aimed at raising the profile of the humble tuber for International Year of the Potato. Photographers are invited to enter images in a contest to honour the root vegetable's role in fighting hunger and poverty, the UN food agency said. "Photographers who explore the world of the potato will find plenty of subject matter," said the Food and Agriculture Organisation's roots and tubers expert NeBambi Lutaladio.

The contest, part of events marking the International Year of the Potato, will help raise "global awareness of the potato's key contribution to agriculture, the economy and world food security," FAO said in a statement. "Fostering improved potato-based systems (will) help countries achieve the Millennium Development Goals," the Rome-based agency said. Photographers are challenged "to capture the spirit of the International Year in images that illustrate potato biodiversity, cultivation, processing, trade, marketing, consumption and utilisation," the statement said.

Sponsored by Japanese camera maker Nikon, the contest has separate categories for professional and amateur photographers and will award prizes totalling 7,200 euros (11,000 dollars). The deadline for entries is 1 September 2008. Contact for further details: IYP-Photo@fao.org

Fruit Genetic Resources of Albania

Endrit Kullaj

INTRODUCTION

Albania is an ancient home of early crop domestication (Fig. 1). The small country (28.748 km^2) is strategically placed in the Mediterranean Basin, with a variety of ecological niches due to the convergence of Mediterranean and continental climates, the isolation and protection from the predominantly mountainous terrain (heights up to 2700 m), and many valleys and rivers. Albania contains a rich biodiversity with more than 3,200 endemic plant species. This genetic heritage, accompanied by a strong tradition in the horticultural arts, made ancient Illyria (Western Balkans) famous for influencing the economic and cultural development of that region. The change from "hunt and harvest" into "proto-domestication" that occurred after the Ice Age, continues still in some mountainous areas of Albania (Tropojë, Pukë, Has, Skrapar, Përmet, Mallakastër, Librazhd, Mokërr, Gore). Albania now possesses over 60 species and subspecies and hundreds of forms, varieties, populations and primitive landraces of endemic and sub-endemic fruit crops that constitute the heart of the natural landscape of the country. Although the area is little known to outsiders, there are enormous opportunities to preserve a great many species, sub-species, and local and Balkan landraces of temperate fruits, especially grapevine and olive.

FRUITS OF ILLYRIA

The natural ecosystems of Albania, the center of ancient Illyria, contain spontaneous and wild forms of many fruit trees and shrubs, including apples (*Malus*), pears (*Pyrus*), quinces (*Cydonia*), cherries (*Cerasum*), almonds, plums, sloes (*Prunus*), pomegranates (*Punica*), figs (*Ficus*), grapevines (*Vitis*), olives (*Olea*), cornels (*Cornus*), rowanberries (*Sorbus*), chestnuts (*Castanea*), walnuts (*Juglans*), hazelnuts (*Corylus*), hackberries (*Celtis*), jujubes (*Ziziphus*), bearberries (*Arctostaphylos*), blackberries, raspberries (*Rubus*), strawberries (*Fragaria*) and vacciniums. A list of *Malus, Prunus, Pyrus,* and *Vitis* species found in Albania is shown in Table 1. From these species, many improved forms of primitive landraces were selected, which became well-known not only in all the regions around Albania but also in the territories of the Roman and Ottoman empires. The French enologist, Monnier (1995), in his book *"Les vins-mets et alcohols des pays de la loire",* proposed that the famous grapes, 'Cabernet Sauvignon', 'Merlot', and 'Gamay', originated from Albania. In fact, many sorts of figs, olives, pears and apples that originated in ancient Illyria (Fig. 1) are well-known in Europe and elsewhere. Archeological excavations, numismatics, place names of fruits, and historical and linguistic sources demonstrate that fruit tree production was one of the earliest and most important economic activities that Illyrians undertook when they started the sedentary life and land tillage in the 2nd millennium BCE.

Illyrian fruits known from antiquity were described and mentioned by ancient authors such as Democritus (460 - 370 BCE), Cato (234 - 129 BCE), Varro (116 - 27 BCE), Virgil (70 - 19 BCE), Strabo (64 BCE - 24 CE), Columella (4 - 70 CE) and Pliny (23 - 79 CE). Many Illyrian names of fruit trees and grapevines are still being used ('Rrush', 'Molla', 'Dardha', 'Gështenja', 'Arra', 'Ulliri'). The renown albanologist, Giuseppe Catapano, in his work *"Thot paralava Albanese"*, proposed the art of viticulture and enology of Egypt and other countries was developed by the predecessors of Illyrians, the Pelasgians. Gamvranic (1983) states that Illyrian clans and Celts in Panonia and Smedereva have developed viticulture long time before the Romans. Clearly, Illyria was a hearth where many of our fruits originated and disseminated in mid-antiquity in regions that included Butrintus, Aulona, Bylis, Apollonia, Durraku, Lissusi. Later on, fruit culture developed in interior regions of the Illyrian territory such as Dardania, Mati, Gramshi, Gora, Skrapari, Delvina, Tepelena, Berati, Elbasani.

HISTORY OF ALBANIAN HORTICULTURE

Trade and demographic movements stimulated the development of orcharding practices and

processing of fruits into wine, sweet drinks, concentrated musts, dry fruits, and oil in the case of olive. Continued developments of fruits, olives and grapevine cultivation were experienced during the Byzantine period (5th to 11th century CE), especially in the hilly and pre-mountainous areas, facilitated by the excellent road network built up by Romans (Egnatia Road) as well as the dissemination of Christianity, which promoted the production of wine and olive oil, necessary for the sacred celebration (Santa Cena or Mensa Eucarist).

With the fall of the Roman Empire and succeeding wars with continuous military excursions, orcharding was abandoned due to the large-scale devastation of plantations and traditional productions. Orcharding, as an economic activity that requests stability, knowledge and skills, tradition and continuity, could not develop under barbarian invasions. Thus, many plantations of grapes and olives were cut and burned, especially in the coastal areas and deep valleys (15th - 16th centuries). Since that time, fruit tree production remained concentrated in remote mountainous areas or valleys (Mat, Skrapar, Tepelena, Gramsh, Berat, Mallakastra, Dibra, Korça, Permeti, Delvina). During the centuries, fruit culture was kept alive in religious communities including churches, monasteries and mosques. The lowlands and hilly coastal areas (Himara, Vlora, Fieri, Mallakastra, Delvina, Lushnja, Durresi, Lezha, Shkodra) were distinguished for the cultivation and use of figs, pomegranates, non-native white mulberries, pears, pergolas. In vast mountainous areas (Tropoja, Puka, Dibra, Korça, Mirdita, Pogradeci, and highlands of Elbasani, Gramshi, Librazhdi), inhabitants conserved and propagated chestnuts, walnuts, apples, quinces, pears, plums. Examples of traditional Albanian cultivars are shown in Fig. 2.

No significant impetus to horticulture was provided by the government of Albania after independence (1912) although Albania had favorable conditions for the cultivation of many fruit species as well as a great range of indigenous and introduced cultivars from the East (Greece, Turkey, Arabia, Egypt) and West (Italy, France, Austro-Hungary). One of the pioneers of a proper European-model orchard was established in 1891 by a Hungarian nobleman in Fier with the best introduced cultivars of apple, pear, almond, cherries and grapevine. That model was disseminated later by other owners of large properties in Vlora, Lushnja, Tirana, Durrës, Shkodra, Elbasa, Korça and Pogradec, attempting to approach the

Table 1. Indigenous fruit species of Albania by location.

Genus	Species	Location
Malus	*M. dasyphylla*	Dibër, Lezhë, Malësi e Madhe, Mat, Pukë
	M. fiorentina	Mokërr, Pogradec
	M. pumila	Berat, Elbasan, Skrapar
	M. sylvestris	Berat, Burrel, Dibër, Librazhd, Mallakastër, Mokër, Skrapar, Tiranë
Prunus	*P. armeniaca*	Durrës, Kruja, Tirana
	P. avium, P. mahaleb	Berat, Elbasan, Kruja, Leskovik, Tirana
	P. cerasus, P. cerasifera	Devoll, Dibër, Gore, Kukës, Librazhd, Mokë, Ostrovicë, Pukë
	P. domestica	whole country
	P. padus	central mountainous areas
	P. prostrata	Burrel, Librazhd, Martanesh
	P. spinosa	Gore, Lenie, Martanesh, Mirditë, Skrapar, Tepelenë
	P. communis	Leksovik, Librazhd, Mokër, Opar, Përmes
	P. divaricata	Devoll, Librazhd, Pogradec
	P. persica	Elbasan, Kruja, Shkodra, Tirana
	P. pyraster	Berat, Elbasan, Korçë, Kukës, Librazhd, Malësi e Madhe, Pogradec, Skrapar, Tiranë
Pyrus	*P. amygdaliformus*	Himarë, Kolonjë, Librazhd, Mat, Mokër
	P. eleagrifolie	Berat, Korçë, Tepelenë
Vitis	*V. sylvestris* var. *pubescens*	Berat, Burrel, Elbasan, Gorë, Gramsh, Skrapar, Tepelenë
	V. sylvestris var. *glabra*	Divjakë, Lezhë, Vlorë
	V. vinifera ssp. *vinifera*	Divjakë, Lezhë, Vlorë

Figure 1. Map of ancient Illyria and modern Albania.

European model of orcharding. However, such orchards were only 'oases' in the cultural-professional 'deserts' as a result of the previous centuries of wars and conflicts.

During the communist regime, the Government established large plantations and nurseries reaching 120,000 ha or 18% of the arable land, mostly on hillsides with introduced commercial cultivars, but some remarkable local grapevine cultivars (the famous 'Shesh i Zi' and 'Shesh i Bardhë') still constituted a large part of grape plantings. However, despite the high level of investment in human and financial resources, the development of horticultural industries was low due to improper organization and terrains, inefficiency in implementation by using underpaid, unskilled workers, improper balance between fruit tree species (50% apples, plums and figs neglecting walnuts, almonds, pears, apricots and citrus), lack of marketing, and low yields.

FRUIT GERMPLASM IN PERIL

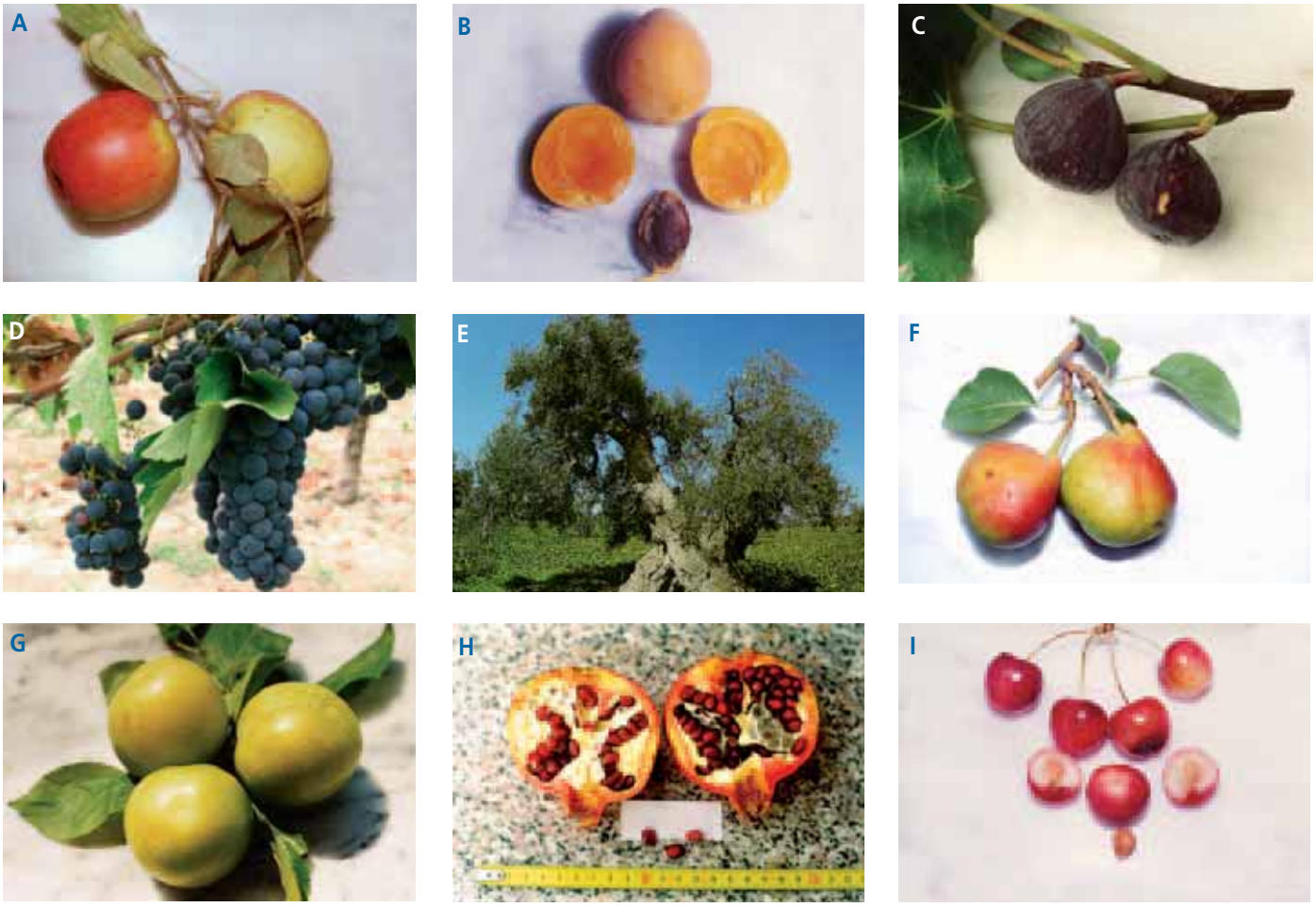
Albania's germplasm, once typical of a wider territory of southeastern Europe, risks erosion and disappearance as has occurred in many other regions. Lack of proper awareness, lack of funding, and short-sighted governmental policy pose great threats to conservation efforts of scientists and passionate amateur growers, who for generations had preserved the unique richness of Albanian patrimony. With the recent problems of fires and global warming, the rate of extinction may be higher than in any other European country.

In the face of this current danger, there is an immediate need to collect and conserve such diversity. The large collections of fruit germplasm established during the regime of Enver Hoxha were often destroyed as was much public property in an attempt to restore confiscated private property. Recently, proliferation of private dwellings has often been constructed in the sites of living genebanks. After the 1990s, projects have been carried out to identify and evaluate such germplasm but a national genebank of fruit trees or even local ones, unfortunately remain to be constructed.

As signatory of the Convention of Biological Diversity (CBD) as well as to implement the provisions of FAO Global Plan of Action (GPA) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), the Government of Albania should be more committed to undertake the challenge of ensuring the long-term conservation of plant genetic resources (PGR). However, in the context of a limited budget devoted to agricultural research or even agriculture in general, the invasion of imported fruit from the neighboring countries, and much more important priorities, the issue of fruit genetic diversity is not high on the government's agenda. Therefore, the Swedish International Development Agency has initiated a regional project (SEEDNet - *South East European Development Network for Plant Genetic Resources*, (http://www-seednet.cbm.slu.se/) in order *"to contribute to the long-term conservation and sustainable utilization of the diversity of PGR within the region through a well coordinated network of functional national programs."*

Given the current difficulty of "in situ" preservation as well as the need for the proper evaluation and use of these resources, we have agreed to use funding allocated for national projects to establish a Fruit Gene Bank with three Regional Collections. The Gene Bank will be maintained at the Experimental and Didactical Enterprise of Agricultural University

Figure 2. Traditional fruit cultivars of Albanian fruits: (A) 'Frakulla' apple, (B) 'Kumardha' apricot, (C) 'Kuqi i Laknasit' fig, (D) Kallmet' grape, (E) old olive tree, (F) 'Qinami' pear, (G) 'Shengjine Tapizes' plum, (H) 'Deveedishe' pomegranate, (I) 'Ndroqi' sweet cherry.



of Tirana while the Regional Collections will be managed by the Centers for Agricultural Technology Transfer (ex-agricultural research institutes, which among other research activities, have been dealing with local germplasm). Such centers will collect and maintain all the indigenous and naturalized fruit trees. Moreover, they will maintain a duplicate of all accessions kept in the National Gene Bank for several species that are appropriate to that region. Under the SEEDNet budget, there is also a provision for *"on farm"* conservation, awareness activities, and the preparation of a National Strategy for the Conservation of Plant Genetic Resources. In the drafting process of this National Strategy, the definition, reorganization, and preservation of the centers with a richer biodiversity in Albania must be defined. These areas can be rescued by setting up economic units of agro-forestry, managed and used by groups of licensed farmers and under mutual state-community obligations in order to make the system of germplasm preservation sustainable. Considering the lack of established collections as in most countries, the indigenous genotypes are mostly found on private property or farms. Therefore, one of the activities that we are carrying out is to trace them, describe, collect and make sure that they are conserved and well-maintained by paying to the farmer a compensation for the services of costs such as fertilization, pruning, irrigation.

THE FUTURE

Research is required in order to save Albania's germplasm. There need to be in-depth taxonomic studies of important genera such as *Malus, Pyrus, Prunus, Vitis, Olea, Cornus, Sorbus,* to define and characterize their diversity within Albania. Although the activities of characterization and evaluation financed under the SEEDNet budget for national projects as well as regional projects are an excellent start, we still have a major interest in collaborating with research institutes worldwide. The expansion of agrotourism could help the country economically. This could be aided by local use of organic products of species of *Juglans, Corylus, Castanea, Juniperus, Pyrus, Rubus, Crataegus, Cornus, Arbutus, Vaccinium, Sorbus, Malus,* and *Prunus.*

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Bourbon Vanilla: Natural Flavour with a Future

Rémi Kahane, Pascale Besse, Michel Grisoni, Fabrice Le Bellec and Eric Odoux

Vanilla, the most famous and marketed aroma in the world, is among the least natural edible compounds at present since 95% of vanillin production, the main compound of vanilla flavour, is synthetic and industrial. Little is known about the orchid *Vanilla planifolia*, the original source of the most widely known and most beloved flavour in the world. This orchid, indigenous to the New World and widely appreciated in pre-Columbian America, was only truly domesticated in the 19th century. Its culture is intimately linked to humans by virtue of the requirement for hand pollination, a lengthy (9 month) fruit maturation, and a secret aroma revealed after a 6 month complex process. This crop provides thousands of small scale farmers in Madagascar (Fig. 1), Comoros, Uganda and other developing countries with

the highest added value of any legal crop. Vanilla is also a model plant that is being actively investigated by a few research teams around the world.

Figure 1. Vanilla grower in Madagascar.

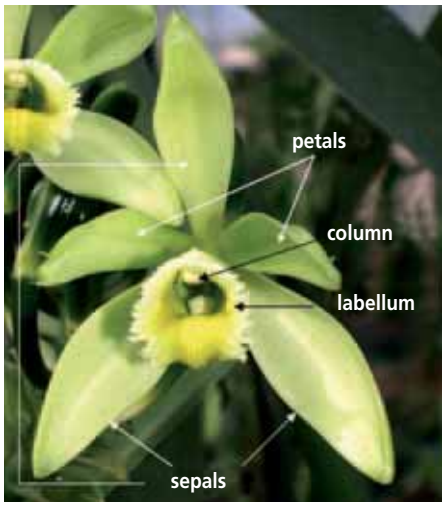
ECONOMICS

Bourbon vanilla is named after the islands in the Western Indian Ocean comprised of Reunion, Madagascar, and the Comoros. This region produces more than 80% of the world production, Madagascar being the historical and traditional leader with a potential of 2,000 tonnes of black vanilla. Indonesia, Mexico, Uganda, India, Papua New Guinea and China are the other major exporters; the USA, Europe (firstly France) and Japan are the main importers. Bourbon vanilla and Mexican vanilla have genetically the same origin but differ in quality, expressing the strong influence of environment. Bourbon vanilla annual production is estimated between 2,000 and 3,000 tonnes of final product. This uncertainty due to climatic and political factors (instability of some developing countries) made great variations in market price in the past 6 years, from 25 to 400 US$ per kilogram! Shortage and speculation are never appreciated by food industries that moved towards synthetic aroma for most of their new dairy and fresh products (ice creams and yogurts). Market share of natural vanilla dropped below 5% in 2004, less than 2,000 tonnes, and hardly benefited from the various labels (organic, certificate of origin) developed by some exporters to keep higher margins.

BOTANY

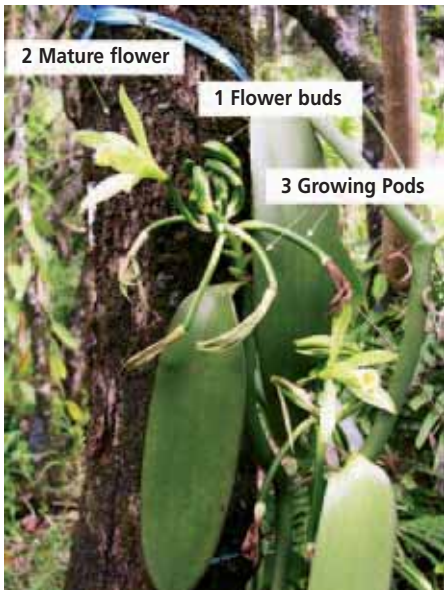
Current phylogenic studies place *Vanilla* as an ancient genus within the Orchidaceae, in the Vanilloidae sub-family, Vanilleae tribe and Vanillinae sub-tribe (Cameron, 2005; Bory et al., 2007). The number of recognised species in the *Vanilla* genus is 110 (Portères, 1954), but this is currently being revised (Soto Arenas, 2003; Bory et al., 2007). *Vanilla* species are naturally distributed throughout America (52), Africa (24) and Asia-Oceania (34) between the 27th north and south parallels.

Figure 2. *Vanilla planifolia* flower.



Vanilla species are terrestrial, epiphyte or semi-epiphyte perennial vines with monopodial growth. Flowers are typical of orchids with three sepals and three petals. One petal, called the labellum, is shaped like a cornet and is attached to the column, bearing one stigma and one stamen with two pollen sacs (Fig. 2). Such a conformation requires specific insects as pollinators, such as bees of the *Euglossa* and *Eulaema* genera in America (Soto Arenas, 2003). After pollination, the ovary develops into a fruit – botanically called capsule but usually bean or pod – containing thousands of seeds (Fig. 3). Species bearing aromatic pods are restricted to America. Fruit fragrance could represent an adaptation to bat dispersal and a synapomorphy of the genus (Soto Arenas, 2003).

Figure 3. Inflorescence and pods of *Vanilla planifolia.*



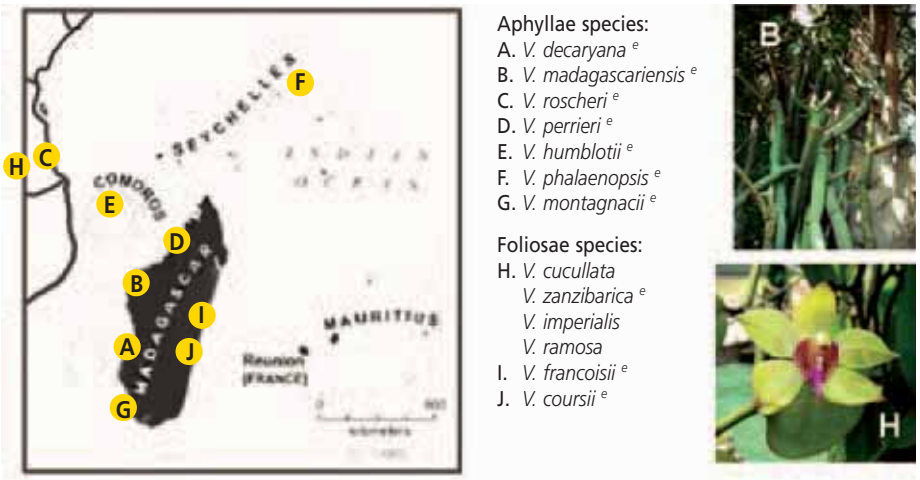
Recent bio-geographical studies based on molecular phylogeny suggested a South American origin of the genus possibly prior to the break-up of Gondwana, and a vicariate migration to the Old World, Africa first, then Asia (Cameron, 2005). Under this scenario African and more particularly Indian Ocean *Vanilla* species are a model of choice for evolutionary studies in the genus as they represent a phylo-geographical bridge between American and Asian *Vanilla* species. Thirteen species are naturally distributed in the Indian Ocean area (Madagascar, Comoros, Seychelles, Zanzibar, Mozambique, Tanzania, South Africa), of which 10 are endemic (Fig. 4).

HORTICULTURE

The only true source of 'Bourbon' vanilla is the cured fruit of the species *Vanilla planifolia* G. Jackson (ex Andrews), syn. *V. fragrans* (Salisb.) Ames. This species supposedly originates from evergreen forests in Mexico, where Aztecs gathered vanilla pods for their use as medicine or to flavour hot chocolate drinks with earliest records dating from 1427. The first vanilla plantations were established from 1767 by the Totonac Indians in the Veracruz region. Following Colombus' (1492) encounter with the New World, *V. planifolia* was disseminated from its area of origin (Fig. 5). Plantations were easily established by cuttings, but the lack of natural pollinators in introduction areas hampered pod production until the discovery in 1941, in Reunion Island, of a practical method of hand pollination. From Reunion Island, vanilla cuttings rapidly spread to Indian Ocean area and worldwide (Fig. 5). This signalled by the 1870s the rise and eventual dominance of the Indian Ocean (Madagascar, Comoros, Reunion Island) as the major vanilla exporter in the world till now.

This dissemination history is responsible for the extremely low levels of genetic diversity observed in vanilla plantations worldwide as shown by recent molecular genetic studies (Duval et al., 2006; Minoo et al., 2008; Schreedar et al., 2007) suggesting a single clonal origin for vanilla crop. This clone could correspond to the lectotype that was introduced, early in the 19th century, by Marquis of Blandford into the collection of Charles Greville at Paddington (UK), from where it would have been disseminated worldwide via botanical gardens of Paris (France) and Antwerp (Belgium) (Bory et al., 2007). A level of genetic diversity approaching uniformity is a clear and common cause of concerns, particularly with regards to pathogen outbreaks or to possibilities for genetic improvement. For these reasons, genetic resources from vanilla primary gene pool (wild and cultivated *V. planifolia*) or secondary gene

Figure 4. *Vanilla* species naturally occurring in the Indian Ocean area (e = endemics).



Aphyllae species:
A. *V. decaryana* [e]
B. *V. madagascariensis* [e]
C. *V. roscheri* [e]
D. *V. perrieri* [e]
E. *V. humblotii* [e]
F. *V. phalaenopsis* [e]
G. *V. montagnacii* [e]

Foliosae species:
H. *V. cucullata*
V. zanzibarica [e]
V. imperialis
V. ramosa
I. *V. francoisii* [e]
J. *V. coursii* [e]

pool (related wild *Vanilla* species) are currently receiving a growing attention worldwide for their protection (Bory et al., 2007; Grisoni et al., 2007) and their possible use to improve vanilla crop production and quality (pathogen resistance, drought resistance, self pollination, aromatic quality...) through conventional breeding programs.

Ecology

Vanilla plant best grows in a temperature range of 21-32°C and about 2,000 to 2,500 mm rainfall per year, including a water stress of 45-60 days to initiate flowering. Higher temperatures that can be reached when shading is not sufficient are fatal to the plant. In their natural habitat vanilla vines grow in margins of rain forests. Their aerial roots help in climbing tree trunks whereas they contribute to absorb water. Too dark shading stimulates vegetative growth to the detriment of flowering. Conversely, too bright sunshine induces leaf and stem burning; optimal shading averages 40% sunlight. Vanilla vine stands most types of soil as it only matters with superficial layers and organic matter, in close association with symbiotic fungi of genus *Rhizoctonia*.

Vanilla crop is established from cuttings taken from vigorous donor vines well fed with organic matter and no stress. Such donor vines will never flower but can produce several 2 m long cuttings per year. Once planted, the cutting will be handled in order to stimulate its growth for the first two years, using the technique of looping to increase rooting through the organic substrate. This also maintains plants at human height and facilitates hand pollination and harvesting. Flower induction will occur only in year three, during the dry season. Fine tuning this inductive stress is not always possible and explains large variability in vanilla yield from one year to the other.

In most of the cropping areas where it has been brought and acclimatized, vanilla misses natural pollinators and needs artificial ones. Hand pollination is historically attributed to a slave named Edmond Albius in Reunion Island. Till nowadays, the technique has remained unchanged and experienced manpower is required to detect early morning opened flowers and hand pollinate them (Fig. 6). A qualified person can pollinate up to 3,000 flowers a day. One and a half months later vanilla beans reach maximum length (Fig. 7), and a total of 8-9 months is needed to achieve maturity. The colour turning from green to yellowish is a visual sign for processing the beans, still odourless.

Figure 6. Hand pollination of vanilla flower.

Figure 5. *Vanilla planifolia* dissemination from Mexico for cultivation: Early dissemination records following C. Colomb (orange); 18-19th century dissemination routes (purple) and dissemination records following E. Albius hand pollination method discovery in Reunion Island (black). The Blanford/Greville specimen route is in bold (compiled from the review in Bory et al., 2007).

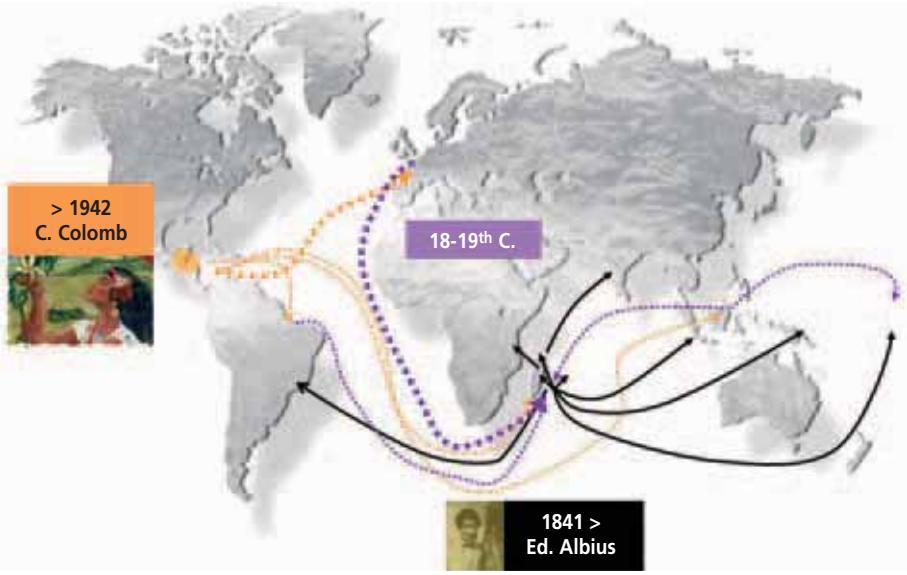


Figure 7. Green bean or pod, fruit of *Vanilla planifolia*.

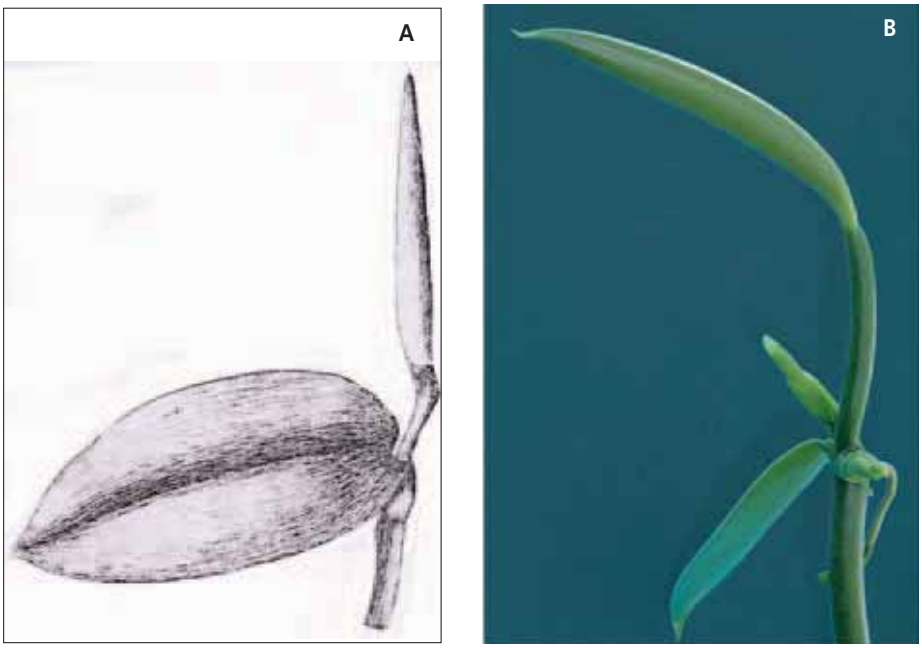
Figure 8. Decreasing biological diversity of the vanilla agro-ecosystem in relation to its intensification. A: Under-wood extensive production system (St Philippe, Reunion Island), B: Semi-intensive system on *Dracaena reflexa* (St André, Reunion Island), C: Intensive system under shade house (St André, Reunion Island).

Agro-systems

From the collection of pods arising naturally on vines growing in the humid forests of Meso-America in the beginning of second millennium, to the production of abundant crops in shade houses, several steps of domestication of vanilla have occurred. Many of the innovations that led to modern vanilla cultivation took place in the Indian Ocean islands during the last two centuries. Discoveries of hand pollination and curing process of vanilla pods are amongst the most decisive ones. Nowadays, cultivation systems of vanilla can be divided into three categories according to intensification level (Fig. 8):

1. The "traditional" or extensive management consists of planting vanilla cuttings on selected trees of a forest and entails limited modifications of the environment (reduction of excessive shading, weeding and mulching). Density and production are generally low in this system (about 1,000 vines/ha and hardly more than 100 g of green pods per vine). However, this agro-forestry system is beneficial in terms of sustainability and maintenance of natural areas.
2. The "field" or semi-intensive system, designed to increase plant growth, is based on the installation of support and shading trees like *Jatropha* or *Glyricidia* prior to cutting plantation, and on continuous vine supplementation with organic matter. Plant density and production are higher (up to 3,000 vines/ha and 500 g green pods per vine).
3. In the "shade house" or intensive system, support and shading are fashioned artificially and vines are fed mainly with compost imported into the shade house. This elaborate and investment intensive system enables producers to handle 4,000 vines/ha and yields to reach 1 kg green pods per vine. High plant density represents higher risks of contaminations and losses, and needs skilled management of plant and human resources.

Figure 9. Abnormal tubular leaf (approximately 8x1 cm) observed (A), on *Vanilla planifolia* in 1899 (reproduced from Jacob de Cordemoy, 1899) and (B), on *V. planifolia* infected by *Cucumber mosaic virus* in 2003.



Major Phytosanitary Constraints

As vanilla cultivation developed into more intensive and sophisticated practices, the occurrence of pests and diseases became more detrimental on the plantations. Virus diseases exemplify the increased phytosanitary constraints that vanilla growers had to face in the last decades. There are indications that virus diseases affected vanilla early in the domestication process (Jacob de Cordemoy, 1899) (Fig. 9). However, the occurrence of a high incidence of viruses on vanilla was firstly reported in 1986 (Wisler et al., 1987). In the following twenty years, nine additional virus species have been recognized to naturally infect vanilla (Pearson et al., 1993; Farreyrol et al., 2001; Grisoni et al., 2006). Among these viruses *Cymbidium mosaic virus* (CymMV, *Potexvirus*), *Cucumber mosaic virus* (CMV, *Cucumovirus*) and several potyviruses are most prevalent and harmful (Fig. 10). The CMV and potyviruses are primarily disseminated by aphids in a non-persistent manner while the CymMV is only (albeit efficiently) disseminated by cuttings or wounds. It is likely that intensifying the cropping system in vanilla has exacerbated the incidence of these viruses by enhancing their propagation. In Reunion Island for instance the first attempts to develop inten-

sive plantations under shade houses resulted in high losses due to the planting of CymMV infected vines and subsequent mechanical spread of the virus to the whole plots, which rapidly declined (Benezet et al., 2000). On the other hand, the environmental changes entailed in the vanilla agro-system also enhanced aphid transmission of viruses present in weeds or neighbouring crops. These changes in epidemiological scenario are likely to account for most of the striking epidemics of aphid-borne diseases observed worldwide. In Madagascar, broad surveys conducted between 1998 and 2003 showed a null or extremely low incidence of potyviruses in all traditional plantations (<1% of the vines). Conversely, in intensive plots, aphid-borne virus outbreaks were observed that could reach up to 40% incidence, two years after planting.

Figure 10. Virus diseases on vanilla. From top to bottom: Chlorotic and necrotic flecks associated with *Cymbidium mosaic virus,* Leaf mosaic due to potyvirus infection, Deformation of leaves induced by *Cucumber mosaic virus* (healthy leaves on the right).

Cym M V

Potyviruses

C M V

Presently, robust, specific and quick methods are available for virus detection (Grisoni et al., 2006). They allow implementation of sanitary certification to propagate virus-free cuttings and rapid identification of viruses infecting vanilla in order to pinpoint and rogue virus reservoirs. In such a way virus constraints can be satisfactorily controlled providing appropriate prophylactic measures are implemented.

Along with the telluric fungi (*Fusarium* spp. and *Phytophthora* spp.) that are being responsible for the decay of millions of vines every year throughout the world, virus diseases and scale, *Conchaspis angraeci* Cockerell (Fig. 11), are the major constraints to Bourbon vanilla. They severely hinder the efficiency of vanilla production, particularly in the present context of alternating phases of intensification and abandonment of plantations in relation to fluctuating vanilla market prices. Additional tools are still needed to improve phytosanitary control, and biological means notably based on genetic resistance and antagonist organisms (Richard et al., 2003) would be particularly worth investigating.

Aroma Processing

Vanilla beans are processed immediately after harvest to develop and stabilize the quality of the final aromatic product. Traditional vanilla curing involves three main steps: heat-treating green fruits that includes a "killing" stage (a few minutes in hot water) immediately followed by a "sweating" stage (in crates for 24 to 72 hours) (Fig. 12); a slow drying phase that may last 3-4 months, alternatively in sun and in shade (Fig. 13); and finally (Fig. 14), conditioning in waxed paper for several months to prevent desiccation (Odoux, 2000; Havkin-Frenkel et al., 2004).

Figure 11. Decline of a vanilla vine severely infested by the scale *Conchaspis angraeci* whose toxic saliva induce yellow patches on the stem and leaves. Detail shows a lateral view of an adult female.

Figure 12. Vanilla beans before and after killing and sweating stages.

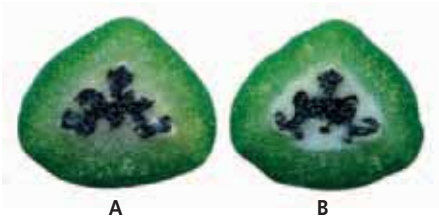
Figure 13. Traditional sun drying phase of vanilla beans, alternating with shade drying in rough bags.

Figure 14. Processed "black" vanilla, traditionally stored and ready for the market.

Cured vanilla bean quality is defined by many criteria of which the most important is aroma. Aroma quality depends on the presence of numerous volatile compounds that appear during curing of the green odourless pods. Among the hundred aromatic compounds identified, the most important and well-known is vanillin but some others may also be cited, such as guaiacol, 4-methylguaiacol, acetovanillin, and vanillyl alcohol, because of their strong intensity in the overall aroma (Pérez-Silva et al., 2006) even if their respective concentration is very low (less than 100 ppm). This diversity in aroma makes the distinction with synthetic vanillin produced from chemical or biochemical pathways.

In a processing point of view, the natural vanilla aromas could be classified in two categories: (1) compounds produced from complex reactions from chemical and/or enzymatic origin (i.e. Maillard reaction, protein breakdown, lipid and polyphenol oxidation, etc.), such compounds presenting human health potential protective properties; (2) compounds like vanillin that are already present in green beans as glucosylated precursors, with no olfactory properties. These glucosides are hydrolysed during the curing process that enables release of their aromatic moiety. Recent studies on factors affecting this hydrolysis reported that it is only due to one endogenous glucosidase. This enzyme and its major substrate, glucovanillin, are localized in the central part of the fruit (Fig. 15), but in distinct cell compartments to prevent spontaneous hydrolysis in the green fruit (Odoux et al., 2003). Any treatment that enables cellular decompartmentalizing was reported also enabling glucovanillin hydrolysis: heating, freezing, or crushing for instance. Other studies showed that "killing" and "sweating" stages of traditional vanilla curing damaged only partly cell compartments, but strongly enzyme activity. This would explain why glucovanillin hydrolysis is not complete at this step of curing. Such hydrolysis should continue during drying stage although no more glucosidase activity was measurable (Odoux et al., 2006). Thus, when correctly practiced, traditional curing appears efficient enough to hydrolyse the whole glucosylated precursors, but about 50% of the vanillin released is lost through different chemical pathways (Gatfield et al., 2007). This would provide objective arguments for improving traditional knowhow and practices, and objective criteria for high quality natural vanilla. The combination of genetic, human and environmental factors influencing vanilla final quality is still to be studied, with potential marketing benefits to small scale farmers through quality labels and certificates of origin.

Figure 15. When a fresh slice of vanilla beans (A) is frozen (B), a milky whitish area appears around the seeds. Glucovanillin is found exclusively in this area with most of the glucosidase activity.



RESEARCH POTENTIAL

Vanilla is one of the few crops that combines a natural image with a high socio-economic value due to its traditional and sustainable mode of production and process. Despite the great potential for smallholders in developing countries, there had been little interest in international research. However, scientific studies on health benefits, on plant breeding, and promotion of the use and consumption of natural vanilla are now being pursued all over the world under the leadership of GlobalHort. INIFAP, Veracruz, Mexico, Spice Board, India, and CIRAD and University of La Reunion, France, are among the major public research institutions engaged at least in one of these themes. A research team in Tahiti, French Polynesia, is also focussing on characterizing and improving the quality of *Vanilla tahitensis*, the local vanilla highly purchased by Japanese and European gourmets. Efforts to establish a vanilla germplasm collection in Madagascar have not been successful till now, but that would integrate the recent platform of processing technology developed at CTH Tamatave. There is a tremendous field for public-private partnership around this crop for the benefits of both small scale producers and consumers: in such a view, GlobalHort considers vanilla as a model crop and encourages stronger networking for scientific activities.

About the Authors

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New Books, Websites

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

BOOK REVIEWS

Agricultural Research Management. Gad Loebenstein [Agricultural Research Organization, Bet Dagan, Israel] and George Thottappilly [Sahradaya College of Engineering and Technology, Kodakara, Kerala, India] (eds.). 2007. Springer, Dordrecht, The Netherlands. 388p. + 15 illus. in color. ISBN 978-1-4020-6056-4 (Hardcover). Price in North America: US$ 229.

This multi-author book edited by Loebenstein and Thottappilly includes 19 chapters in two clusters: general and case studies. The nine general chapters (half of them written by researchers or managers involved in international agriculture) refer to mission, evolution, priority setting, agenda, organization, leadership, bioethics, information and communication technology and harnessing agricultural research. With such a diverse content and writing skills among the co-authors, one can read superb chapters with new information, details on approaches and critical assessments as well as more conventional text just providing an account on the state of the art in each subject. The nine case studies deal with the Consultative Group on International Agricultural Research (CGIAR), United States Department of Agriculture (USDA), US Land Grant University System, USDA-Cooperative State Research, Education and Extension Service (CSREES), Nigeria, French National Institute of Agricultural Research (INRA), India, the Netherlands, and Israel. The various research systems assessed in each of the case studies show how they depend on their respective funding environments and end-user demands. Perhaps learning from each international or country experience will allow following best practices for managing reduced availability of resources for agricultural research. It was therefore not surprising, in this time of shrinking public resources, that some general chapters (especially those on priority setting and approaches for defining the agenda) pay attention to how resources may be allocated for setting the research undertakings that heavily depend on competitive external funding. It was argued by the editors of the book that *"grant funding should not be more than 30% of the total; otherwise the main mandate of the institute will be neglected"*. Surely, institutional wisdom will be needed to manage resources and adopt best practices to ensure that agricultural research delivers the goods needed for increasing outputs and quality of the produce worldwide. In the concluding chapter, the editors summarize the major findings as provided by each chapter, and bring into their analysis,

the issues that are shaping today agricultural research management: leadership, budgets, open house, annual research review and planning meetings, staff promotions, use of citation index to assess research quality outputs, patents, sabbatical leave, use of modern technology, public-private partnerships, information and communication technology, among others. They also point out the need for increasing funding as well as changes in education and curriculum to attract new talents, and shaping the agenda through a sustainable agriculture approach that will also benefit the growers (and not only consumers who enjoy cheap food prices). The last section of this last chapter refers more to recruiting and managing staff through right interview process, a competitive salary system, and merit- rather than seniority-based performance rewards. Loebenstein and Thottappilly end their chapter advocating the need for both efficiency and transparency for managing research organizations that should lead to motivate staff to perform better and deliver better results for the benefit of farmers. They are confident that there should be room for improvement in research organizations and hope their book provides to their managers with methods, procedures and thoughts that can be used for enhancing the performance of international and national agricultural research institutes, especially those operating in the developing world. This book has been written for managers, researchers and students interested in agricultural research and its management and therefore they should consider acquiring it.

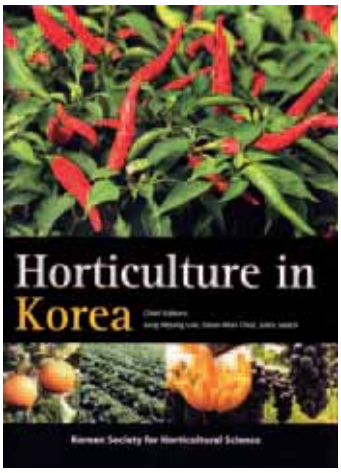
Agricultural Research at the Crossroads: Revisited Resource-poor Farmers and the Millennium Development Goals. Bo M.I. Bengtsson. 2007. Science Publishers, Enfield, New Hampshire, USA. 350p. ISBN 978-1-57808-514-9. Price in North America: US$ 59.50.

This book, written by a Swedish professional who spent some of his career as senior officer in international aid and sat in boards of research and development organizations, comes at a time that the CGIAR starts a new soul-searching process through a recently launched "facilitated-change management process". The author advocates the need for integrating field data relevant to policy with up-to-date information for synthesis into scenarios and a vision about how research and development (R&D) in agriculture can best serve those in most need, and who also have little access to productive resources. The contents include chapters into global agriculture, agricultural development, adoption of innovations, global trends to food security and safety, globalization and agribusiness, global food supply, technology and trends in agricultural research, reflection on future research and development, the CGIAR, university teaching, and development assistance and science aid to agricultural R&D. The book also has a useful glossary and list of acronyms and abbreviations. As pointed out by the publisher *"this publication is an attempt to stimulate discussion on future options on research policy, suggesting changes in agricultural R&D for societal development in accordance with the Millennium Development Goals and future science aid to agriculture."* This provocative-thinking book will be therefore an important resource for policy-makers dealing with international agriculture as well as for teaching students on the subject.

Above books were reviewed by Rodomiro Ortiz, CIMMYT, Mexico

Horticulture in Korea. Jung-Mung Lee, Geun-Won Choi and Jules Janick (Chief editors). 2007. Korean Society for Horticultural Science, Suwon, Korea. 391p. ISBN 978-89-92259-04-0 93400 US$50.

This volume reviews the state of horticulture and horticultural science in Korea. Compiled by over 100 well known Korean professors and researchers, the work provides information related to the history and development of horticulture and horticultural sciences, education, and horticultural organizations with detailed up to date reviews of various horticultural crops intimately associated with Korean agriculture. The book is profusely illustrated in color with extensive tabular material. The publication of the book was part of the activity of the International Horticultural Congress (IHC 2006) held in August, 2006 in Seoul.



NEW TITLES

Akinnifesi, F.K., Leakey, R.R.B., Ajayi, O.C., Sileshi, G., Tchoundjeu, Z., Matakala, P. and Kwesiga, F.R. (eds.). 2008. Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialization. CABI Publishing, Wallingford, UK. 438p. ISBN 978 1 84593 110 0 (hardback). €120.00 / £75.00 / $150.00. www.cabi.org

WEBSITES

The Italian Society for Horticultural Science (SOI - Società di Ortoflorofrutticoltura Italiana) opens the door to its word, with a new website. You can find it at www.soihs.it. The web is open for contributions and news from SOI members and it is designed to allow any exchange of horticultural news worldwide. It is the perfect place for advertising new horticultural books, congresses, meetings, seminars, any horticultural event! SOI, created in Florence in 1953, is today, with 1000 members, one of the largest horticultural societies at country level. SOI's body is made by three Sections: "Fruit", "Flowers and Ornamentals" and "Vegetables".

SOI publishes a Newsletter and its scientific Journal "Italus Hortus" in which we host congress proceedings and review papers, under the Scientific Direction of Prof. Massimo Tagliavini and the Editorial Direction of Prof. Elvio Bellini. Articles are in Italian with a large abstract in English.

SOI organises, since 1992 and every three years, the "Giornate Scientifiche" (the general meeting with the members of the three Sections of the Society) and more than 30 events every year.

We hope you will enjoy your visit to our website!

Paolo Inglese, SOI President

Courses and Meetings

The following are non-ISHS events. Make sure to check out the Calendar of ISHS Events for an extensive listing of all ISHS meetings. For updated information log on to www.ishs.org/calendar

The National and Trans-Tasman Horticultural Science Conference, 21-23 July 2008, Gold Coast, Australia. Info: Mr. Craig Henderson, LMB 7, MS 437 Gatton, Queensland 4343, Australia, Phone: (61) 7 5466 2214, email: craig.henderson@dpi.qld.gov.au, Web: http://www.aushs.org.au/EventsandIssues/NTHSConference/tabid/2583/Default.aspx

International Master in Plant Breeding (17th edition), 29 September 2008 - 5 June 2009, October 2009 - July 2010, Zaragoza, Spain. Info: CIHEAM - Mediterranean Agronomic Institute of Zaragoza, Apartado 202, 50080 Zaragoza, Spain, Phone: 34 976 716000, Fax: 34 976 716001, email: iamz@iamz.ciheam.org, web: www.iamz.ciheam.org

Traceability - Tracking and Tracing of Food, 15 October 2008, York, UK. Info: Richard Glass, Central Science Laboratory, Sand Hutton, York, YO41 1LZ, UK, email: r.glass@csl.gov.uk, web: www.aab.org.uk

The 1st International Symposium on Medicinal Plants, Their Cultivation and Aspects of Uses, 15-16 October 2008, Ashoubak, Jordan. Info: Dr. Mazen A. Ateyyat, Al-Shoubak University College, Al-Balqa' Applied University, Al-Salt 19117, Jordan, Phone: 00-962-777-414198, Fax: 00-962-3- 2164035, email: ismpcau@gmail.com, m_ateyyat@yahoo.com or ateyyat@bau.edu.jo, web: http://ismp.bau.edu.jo

Marketing of Fresh Fruit and Vegetables, 20-24 October 2008, Zaragoza, Spain. Info: CIHEAM - Mediterranean Agronomic Institute of Zaragoza, Apartado 202, 50080 Zaragoza, Spain, Phone: 34 976 716000, Fax: 34 976 716001, email: iamz@iamz.ciheam.org, web: www.iamz.ciheam.org

4th International Plant Dormancy Symposium, 8-11 June 2009, Fargo, North Dakota, USA. Info: info@plantdormancy.com or www.plantdormancy.com

35th National Agricultural Plastics Congress, 14-16 July 2009, State College, PA, USA. Info: Michael D. Orzolek, Director, Penn State Center for Plasticulture, 203 Tyson Bldg., The Pennsylvania State University, University Park, PA 16802, USA, Phone: (814) 863-2251, Fax: (814) 863-6139, email: mdo1@psu.edu, web: www.plasticulture.org

International Symposium on Horticulture for Livelihood Security and Economic Growth, 9-12 November 2009, Bangalore, India. Info: Dr. Prem Nath, Chairman, P.N. Agricultural Science Foundation (PNASF), #9, 1st Cross, 1st Main, 1st Block, Rajmahal Vilas (RMV) Extension 2nd Stage, Bangalore - 560 094, Karnataka State, India, Phone: +91-80-23415188, Fax: +91-80-23511555, email: pnasf@vsnl.net, info@pnasf.org, web: www.pnasf.org

Symposia and Workshops

First Symposium on Horticulture in Europe

The First Symposium on Horticulture in Europe (SHE2008) held in Vienna from 17 to 20 February had more than 450 participants coming from 37 different countries (28 European).

The symposium was organised under the aegis of national and regional European horticultural societies and research institutes such as APH (Portuguese Horticultural Association), DGG (German Society for Horticultural Science), GSHS (Greek Society for Horticultural Science), INRA (Institut National de la Recherche Agronomique), PSHS (Polish Society for Horticultural Science), IOH (Institute of Horticulture), SECH (Spanish Society for Horticultural Science), BeneluxSHS (Benelux Society for Horticultural Science), SOI (Italian Society for Horticultural Science), NJF (Nordic Association of Agricultural Scientists), with the local organization of ALVA (Association of Food, Veterinary Science and Agriculture, Austria).

After the plenary lecture held by Prof. Silviero Sansavini, who introduced the symposium giving a broad but deep vision of the most outstanding challenges of the European fruit industry and research, the Symposium discussed six general themes concerning some of the most outstanding topics of world and European horticulture:

ISHS Treasurer Dr. Robert Bogers (left) handing out an ISHS Medal to Dr. Gerhard Bedlan (right).

1. Health aspects: from vegetables to horticultural therapy and from organic to functional foods;
2. Biotechnology: from social issues to "-omics" in European horticulture;
3. Environmental constraints and climate change in Europe;
4. Sustainability of horticulture in Europe;
5. Quality management from monitoring to production to management in shops;
6. Biodiversity and local genetic resources: from knowledge to exploitation.

Each session was introduced by a plenary lecture and included 8 oral presentations.

M. Josephine Amiot-Carlin from INSERM-INRA covered the first issue with an extraordinary clear lecture based on sound research results. Fernie Alidstair covered the second one with a complete lecture able to discover the huge potential of metabolomics for a full understanding and exploitation of the genetic potential of horticultural crops. The second day, Helga Kromp-Kolb from the University of Natural Resources and Applied Life Sciences, Vienna, showed the ultimate data concerning the climate change in Europe, which will most likely lead to great changes in the horticultural as well as in the natural landscape. Lukas Bertschinger from Agroscope (Switzerland) discussed the sustainability topic, showing very interesting and specific research findings, including the domestication of Edelweiss for profitable production in the Alps and the environmental footprints of horticultural production in the UK. Bart

Nicolai from the University of Leuven discussed the most advanced technology to measure taste and aroma of horticultural produce, stressing the importance of a real understanding of the new non-destructive methods of analysis and their calibration for very different commodities as well as growing conditions. Finally, Carlo Fideghelli from CRA, Rome, gave a glamorous lecture on the importance of conservation strategies of local genetic resources, moving from breeding to landscape as well as typical produce and sustainable horticultural systems.

The programme included 8 workshops on very specific topics, chaired by a convener, with 3-5 invited speakers each.

Finally, more than 300 posters have been presented during the symposium.

The number of participants, who attended in a large number each of the sessions until the very last speaker, says that the idea of having the first European meeting was good enough to claim for a second edition!

Many young scientists presented interesting lectures, giving a broad view of the up to date research state of the European horticultural science. The poster sessions were plenty of discussions and interactions.

Dr. Paolo Inglese

Participants enjoyed a wonderful get-together cocktail party hosted at the astonishing Ball Room of the Vienna City Hall, the Rathaus, and offered by the Mayor Governor of Vienna, with excellent food and Austrian wines.

We could not have a better idea than hosting this 1st Symposium in Vienna. The City gifted us with three beautiful and almost sunny days, but the sessions were so busy that just few hours were left to visit the City.

The scientific success of the symposium depends on participants, but it is also the result of the work and the cooperation of many people, public institutions and private enterprises that gave us their valuable support. In particular we wish to thank the Mayor Governor of Vienna, the Vienna Convention Bureau and the Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria, together with DGG, INRA, SOI and the collegues of ALVA as well as from the Horticultural College in Schoenbrunn.

Paolo Inglese and Gerhard Bedlan
SHE2008 Organising Committee

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First Int'l Symposium on Application of Precision Agriculture for Fruits and Vegetables

Section Citrus - Section Pome and Stone Fruits - Section Vegetables - Commission Horticultural Engineering

The First International Symposium on 'Application of Precision Agriculture for Fruits and Vegetables' was held from Jan. 6-9, 2008 in Orlando, Florida. The Co-Conveners were Drs. Reza Ehsani and L. Gene Albrigo of the University of Florida Citrus Research and Education Center. The Co-Conveners were ably assisted by Christen Johnson of the Citrus Research and Education Center Publicity Department. Approximately 99 people participated with representation from 17 countries. The meeting was sponsored by the

Participants of the Symposium.

Co-Conveners L. Gene Albrigo (left) and Reza Ehsani (right) welcoming the attendees to the meeting.

International Society for Horticultural Sciences, the International Society of Citriculture, the American Society of Agricultural and Biological Engineers and the Citrus Research and Education Foundation.

The conference offered a wide range of topics covering almost all aspects of precision farming for fruits and vegetable production. Papers were presented under the following main sessions: remote sensing, sensing and control systems, site specific management, automation and robotics, as well as economic, quality and environmental issues. The most focused sessions with the most papers were on remote sensing and hyperspectral imaging, new sensors and data collection technologies, robotics and automations, and advanced technology for future orchards. There were 43 oral and 19 poster presentations on these subjects. Remote sensing was highlighted by a presentation by Dr. Pol Coppin (Katholieke Universiteit Leuven, Belgium) on 'Hyperspectral monitoring of perennial plant systems.' This presentation covered current knowledge about usefulness of hyperspectral reflectance for monitoring plant condition and plans to place a hyperspectral satellite in orbit in 2010 to evaluate fruit tree condition in real time. The design of a virtual orchard based on and then tested with hyperspectral reflectance data was presented. This process allows evaluation of parameters for data collection for the hyperspectral satellite in 2010. Other presentations in this session covered automated tree counting and canopy volume measurement from high resolution images, and integrating remote sensing data with a software framework to handle the data when collected with a number of different remote sensing platforms.

Dr. Andre Torre-Neto (EMBRAPA, Sao Carlos, Brazil) presented information on 'Instrumented Citrus Production' with emphasis on soil moisture and irrigation monitoring. Other presentations included supply chain monitoring, use of active-passive sensors, use of NDVI sensors to monitor plant condition, sensors and placement for plant nitrogen and soil moisture monitoring.

Dr. Simon Blackmore (UniBots Limited, England) presented concepts for 'A specification for an autonomous crop production mechanization system', which included robotic tractors. Presentations on mechanical harvesting of citrus and cucumbers as well as flower thinning for fruit trees were given.

John Reid (Moline Technology Innovation Center, Moline, Illinois, USA) discussed 'Service robotics for fruit and vegetable automation.' This session included presentations on service and harvesting robots and fruit detection for robotic harvesting.

Lawrence Gaultney (DuPont Agricultural Products, Maryland, USA) was the invited speaker for 'Economic and environmental benefits of precision agriculture in fruit and vegetable production'. Additionally, non-destructive quality measurement, phytosanitary monitoring, and picker aided harvesting were covered with strawberries, peaches, olives and citrus being the crop subjects of various talks.

Following the two days of oral and poster sessions, a tour was provided to see a citrus processing facility; a modern, highly automated citrus nursery; an automated, remote controlled irrigation system; and mechanical harvesting of citrus. The tour group also visited the University of Florida Citrus Research and Education Center at Lake Alfred, Florida.

The attendees thought the meeting subject was timely and worthy of future meetings. The concern about too many meetings tempered the enthusiasm with a request that the meetings on this subject not occur more often than every two years. The group is in favor of designating this effort as Precision Horticulture to distinguish it from the more mundane efforts in agronomic crops. This working group has now been officially formed within ISHS as the 'Precision Horticulture Working Group' under the Citrus Section and the Horticultural Engineering Commission. Dr. Reza Ehsani will be the first Chair.

Oxbo mechanical harvester in a citrus grove.

Rucks Citrus nursery is a highly automated nursery with large roller carts to move the plants from processing room to greenhouses at various stages such as planting, budding and finishing.

Reza Ehsani, L. Gene Albrigo and Christen Johnson

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Section Pome and Stone Fruits - Section Tropical and Subtropical Fruits

Eighth Int'l Symposium on Temperate Zone Fruits in the Tropics and Subtropics

Participants of the Symposium.

The VIII International Symposium on Temperate Zone Fruits in the Tropics and Subtropics (TZFTS), organized by Embrapa, Epagri and Brazilian Fruit Society under the auspices of the ISHS, was held in Florianópolis, Brazil, on 21 to 25 October 2007.

Two hundred and five scientific reports were presented, being 53 oral presentations, 146 posters and 6 lectures. There were 196 inscriptions among which 60 foreigners from 27 countries.

The opening ceremony had the presence of the ISHS President, Dr. Norman Looney, the Embrapa's Director Dr. José Geraldo Eugenio de França, the President of Brazilian Fruit Society, Mr. José L. Petri, Epagri's Director, Dr. Edson Silva and the two Conveners Dr. Flávio Gilberto Herter and Dr. Gabriel Berenhauser Leite. At the opening lecture Dr. Looney pointed out the role of ISHS in the scientific development. He invited the Latin American researchers to participate more actively in international events like the XXVIII International Horticultural Congress to take place in Portugal, in 2010.

SCIENTIFIC PROGRAM

Dormancy Physiology

Dr. Maurício Frías, from Chile, presented a lecture about "Effect of Winter Chilling on Deciduous Fruit Production: A Practical View". He pointed out aspects related to the cold and metabolic process that, in consequence, have an influence on the production's potential.

There were 11 more oral presentations about climate modeling, chilling requirement methods about growth regulators on dormancy elimination, global heating impact, estimate models of endodormancy, floral biology and floral fertilization and abortion.

Resource and Genetic Breeding

A lecture was presented by Dr. David Byrne, from Texas A&M University, United States dealing with "Environmental Challenges of Breeding Peaches for Low Chill Regions". There were 10 oral presentations directly connected to this subject, emphasizing the genotypes adapted to low chill regions, like Thailand and Bangladesh. The genetic breeding for low chill peach adapted to Brazil's condition was discussed. Papers on functional food referring mainly to antioxidants concentration were also presented.

Cultural Practices

Dr. Nigel Cook, from South Africa, gave a lecture on apple production under mild winter conditions in South Africa, integrated production system, orchard management, and growth regulators.

The lecture was followed by oral presentations on cultural practices, and handling of different species under tropical and subtropical conditions, emphasizing the integrated production system. A paper about scion-rootstock compatibility was also presented.

Plant Disease and Pest Control

Dr. Turner B. Sutton, from the United States, gave a lecture about "Epidemiology and Management of Diseases of Temperate Fruit Crops in Subtropical Climates". Oral presentations related to the subject completed this session.

Opening Ceremony. From left to right: Dr. Gabriel Berenhauser Leite, Dr. Flávio Herter, Dr. José Geraldo Eugenio de França, Dr. Norman Looney, Congressman Reno Caramori, Mr. José L. Petri and Dr. Edson Silva.

Mr. Boutin with some visitors, such as the ISHS President, Dr. Looney.

Viticulture

A lecture about "Grapevine Performance and Production Strategies for Tropical Environments" was presented by Dr. Umberto Camargo, from Brazil, followed by oral presentations related to the subject.

TECHNICAL TOUR

On October 25, a technical visit was organized to Mr. Boutin's Farm, located at Curitiba, Paraná. Since 1975 Boutin has been working with fruit such as apple. Nowadays he grows plum (cultivars 'Reubenell', 'Harry Pickstone' and 'Irati'), persimmon (cultivar 'Fuyu'), kiwi fruit (cultivar 'Monty'), Asian pear (cultivar 'Hossui') and apple (cultivars 'Gala' and 'Eva'). At Boutin's Farm modern technologies in fruit production are applied following international rules, such as traceability, biological control, integrated production, modern packing house, test of new cultivars, safety and security production with inspection services. This technology allowed Mr. Boutin to obtain EURO GAP certification, a guarantee of acceptance of its fruit in Europe, USA and Canada, locations to which Mr. Boutin exports its fruits nowadays.

ISHS BOARD MEETING

During the TZFTS Symposium, the ISHS Board got together for its biannual meeting. The ISHS Board was also able to meet with the Presidents of a number of Horticultural Science Societies from South America, among which Ing. Agr. Ricardo Andreau of the Asociación Argentina de Horticultura (ASAHO), Dr. Paulo César Tavares de Melo of the Associação Brasileira de Horticultura (ABH), Dr. Jose Luiz Petri of the Sociedade Brasileira de Fruticultura (SBF), Dr. Antonio Fernando Caetano Tombolato of the Sociedade Brazileira de Floricultura e Plantas Ornamentais (SBFPO), Dr. Jorge Retamales of the Sociedad Chilena de Fruiticultura, Dr. Horst Berger Stumpe of the Sociedad Agronomica de Chile, Dr. Diego Miranda Lasprilla of the Sociedad Colombiana de Ciencias Horticolas, Dr. Andres V. Casas Diaz of the Sociedad Peruana de Horticultura, and Dr. Roberto Zoppolo of INIA Uruguay.

View of Mr. Boutin's Farm.

BUSINESS MEETING

During the Business Meeting Dr. Gabriel Berenhauser Leite, from Brazil, and Dr. Nigel Cook, from South Africa, were elected as the new Chairman and Vice Chairman of the ISHS Working Group on Temperate Zone Fruits in the Tropics and Subtropics. The next TZFTS Symposium will be convened by Dr. Nigel Cook and will be held in Cape Town, South Africa, in 2011.

Flávio Herter

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Int'l Symposium on Underutilized Plants for Food, Nutrition, Income and Sustainable Development

Section Tropical and Subtropical Fruits - Commission Plant Genetic Resources

Participants of the Symposium (by courtesy of O. Matenge).

Over 200 delegates from 55 countries gathered in Arusha, Tanzania, 3-7 March 2008 for an International Symposium on "Underutilized plant species for food, nutrition, income and sustainable development". The Symposium (a joint venture of the Commission Plant Genetic Resources and the Section Tropical and Subtropical Fruits) was co-convened by the International Centre for Underutilised Crops (ICUC) with the Global Facilitation Unit for Underutilized Species (GFU), Bioversity International, GlobalHort, Plant Resources of Tropical Africa, and the World Vegetable Center, whose Regional Center for Africa was the local host.

The symposium was a resounding approval of the need for a working group on underutilized plant species to provide a voice to those who are working on these plants. The delegates endorsed the ISHS Working Group on Underutilized Plant Genetic Resources, which is co-chaired by Dr. Hannah Jaenicke (ICUC) and Dr. Irmgard Hoeschle-Zeledon (GFU), and made suggestions for future collaboration.

Over 150 oral and poster presentations across the four themes: food security, nutrition, income generation and sustainable development demonstrated the sheer number of underutilized species that can contribute to peoples' livelihoods. Usually these species are associated with the culture of the people that use them. Women are the custodians of the associated traditional knowledge.

It was emphasized that building on this knowledge should be encouraged, so that communities can relate to the work and feel ownership of any research carried out. This however requires standardization of methods and a common language (for example in recipes) to avoid misunderstandings and to allow for comparison in studies. Participants recommended the application of modern methods (e.g. tissue culture, biotechnology etc.) to address problems such as unavailability of planting material of desirable cultivars.

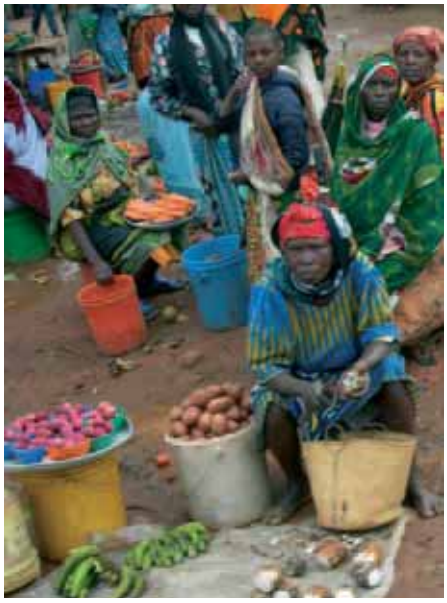
Concerning marketing, the advice was to start building a strong local value chain that can be expanded and only then move on to wider marketing. One has to be aware of the challenges to keep a product on the market in the long-term and of the fact that successful value chains might be taken over by larger companies bypassing the poor - our target group. Whilst in principle technologies for food processing are available, they have to be adapted to the specific products. The development of control systems and quality standards is essential also for local markets: local consumers should also receive quality products.

Presentations on environmental sustainability suggested the need for more integrated approaches to fight genetic erosion, soil and water pollution, loss of forests or to manage risks caused by weedy species. Valorizing plant diversity was shown in the first place as a way to secure income generation. Little has been done with regards to natural resources policies to conserve biodiversity of underutilized plant species. Their conservation still relies on their use. However, the use is facing several constraints, such as overexploitation, lack of markets/promotion, biological risks/legal limitations, little or no research and disorganized communities, which scientists can address, but not solve themselves. It was felt that regarding the last two constraints mentioned, it was our responsibility to share and disseminate information, to participate in training and education efforts, to promote cropping and consumption following good practices.

Finally, the participants developed a series of recommendations around four pertinent issues:

Many women participated (by courtesy of O. Matenge).

Awards were given to outstanding presenters (by courtesy of H. Jaenicke).



Market in Lushoto, Tanzania (by courtesy of H. Jaenicke).

On the opportunity of using underutilized plant species as risk buffers in times of climate change:

1. Build a database on climatic adaptability of underutilized species
2. Identify underutilized species that tolerate various stress situations
3. Involve communities in the conservation, information gathering, knowledge sharing and dissemination

On the opportunity of using underutilized plant species for better nutrition:

1. Establish a database of existing information of nutritive values of underutilized species
2. Develop a local/regional based priority list of top ten underutilized species
3. Create awareness of the importance of diets with nutritional underutilized species
4. Build capacity at all levels throughout the value chain
5. Policy support should be sought from Government agencies (Ministries of Agriculture, Education, Health) to mainstream

Participants at Irente view, Tanzania (by courtesy of H. Jaenicke).

underutilized species in school and hospital feeding programs

On the challenge of enhanced and sustained market access for underutilized plant products:

1. Share and disseminate successful case studies on market access (reasons for success and failure)
2. Develop and implement an advocacy and lobbying strategy
3. Promote partnerships between value actors
4. Carry out and document economic and market studies of different aspects of value chains

On the challenges regarding using underutilized species without undermining agro-biodiversity:

1. Strengthen research on benefits of diverse farming and eco-systems
2. Carry out risk analyses of invasiveness of new species and pressure on biodiversity through promotion of particular species/varieties
3. Develop guidelines and good practices for sustainable use of underutilized species
4. Create awareness at school and community level on importance of biodiversity for their environment, farming systems and eco-systems
5. Set up working groups at national and international level involving researchers, policy advocates and farmer organizations

These recommendations are now being taken forward by the Working Group Chairs and thematic sub-groups will be set up to enhance communication and specific collaboration.

Hannah Jaenicke and Irmgard Hoeschle-Zeledon

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Section Vegetables

Fifth Int'l Symposium on Edible Alliaceae

Group picture in the symposium venue.

From 29 to 31 October 2007, almost 200 international scientists met and discussed the present and future developments of Edible *Allium* crops. It was organized in The Netherlands right in the heart of the onion producing area. The Symposium location was situated 3 meters below sea level in one of the most modern polders of the Netherlands. This meeting was followed by the 2nd World Onion Congress, organized by the World *Allium* Association.
Delegates from 34 countries exchanged their

knowledge and latest results of their research on onions, garlic and leek. Important items like Molecular Breeding and Genomics, Agronomy, Storage and Processing, Pest & Diseases, and Secondary Metabolites and Phytochemicals were discussed. Some highlights of them are discussed below.

The proposal for international plant and *Allium* genomics collaborations was formulated by Dr. Michael Havey (USA), in order to develop a coordinated plan of genomic resources for the Alliums and avoid duplicating or competing efforts.

Dr. John Mc Callum (New Zealand) emphasised the use of ETs (Expressed sequence tags) as the most robust and portable markers for *Allium* genetics and their application in map integration .

We are closer to getting onions that would not make people cry. The results presented by Dr. Kamoi (Japan) and Collin Eady (New Zealand) about silencing lachrymatory factor synthase (LFS), which can produce soon a non-lachrymatory onion, were remarkable.

Dr. Silvana Nicola, Chair ISHS Section Vegetables, during the visit to the breeding station De Groot en Slot in Warmenhuizen.

The development and application of alien addition lines to *Allium* genetics and breeding were presented by Dr. M. Shigyo (Japan) and also Dr. Minh Hang (Vietnam).

A quite efficient methodology for *Agrobacterium*-mediated transformation of garlic was presented by Dr. Fernand Kenel (New Zealand).

Several new approaches to deal with onion smut and onion maggot infections were presented by Dr. Mary Ruth McDonald (Canada). Also practical ways to control onion thrips and *Iris Yellow Spot Virus*, such as weekly applications of formetanate hydrochloride, were presented by Dr. L. Jensen (USA). Advances in the management of garlic virus were presented by Dr. Cecilia Perotto (Argentina). An interesting presentation about genetic variation among *Fusarium* isolates was done by Dr. Guillermo Galvan (Uruguay). An integrated control of white rot on onions, a quite serious disease, was proposed by Dr. Villalta (Australia).

A quite new approach of using garlic and onion as a source of an environmentally benign nematicide was postulated by the well-known *Allium* researcher Dr. Erick Block (USA).

The consumption of onion and garlic is associated with a reduction of cardiovascular and cancer diseases. The characterization of the genetic variability present in onion and garlic germplasm, according to variables related to health-benefits, like antiplatelet activity, polyphenol, fructan and organosulfur composition, was presented by Dr. Claudio Galmarini (Argentina). Also the association between the composition of Alliums and the etiology of human diseases using in vitro and in vivo models and interesting results regarding different cooking strategies of garlic and onions related to their health properties were presented.

Many other interesting results were shared and supported the global research on Alliaceae.

A highlight of the Symposium was the field tour at the breeding station of Groot en Slot in Warmenhuizen. Many varieties of onion and leek from all over the World were displayed. Dr. Henk de Groot gave an interesting presentation about onion and shallot breeding; this activity

Dr. Chris Kik and Dr. John Mc Callum at the poster session.

was an excellent bridge between practice and science.

During the Symposium the working group elected among proposals from Africa and Asia, the one presented by Dr. Shigyo to host the 6th International Symposium on Edible Alliaceae in Japan, during 2011. We want to invite all our colleagues interested in Alliums to join us in Japan. The convener acknowledges all the invited speakers and participants, and the support of all sponsors for making this Symposium a success.

C.R. Galmarini and J.H.J. Haarhuis

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Int'l Symposium on the Socio-Economic Impact of Modern Vegetable Production Technology in Tropical Asia

Remi Kahane (GHI) delivers the concluding address.

Organised by Associate Professor Peter J. Batt from Curtin University in Perth, Western Australia, this inaugural symposium attracted some 66 delegates from 18 countries. The symposium came about as a means to communicate the results of a collaborative research project undertaken by the Asian Vegetable Research and Development Centre (AVRDC), with support from the Asia Pacific Seed Association (APSA) and the Agricultural Economics Research Institute (LEI). Funded by the private sector and the Dutch Government, this study sought to assess the contribution that the vegetable sector makes to smallholder vegetable farmers' income, poverty reduction and increased accessibility to high quality nutritional vegetables.

Conducted over two days from February 4 to 5 in Chiang Mai, Thailand, the findings of the study were supported by 25 contributed and invited papers submitted by other researchers working in the region. In his opening address Dr. Thomas Lumpkin spoke of the many challenges facing the vegetable industry in Asia. While increasing vegetable production and consumption can benefit the poor and facilitate national development, many factors are involved. Increasing incomes and urbanization are changing diets and market requirements. Vegetable production is becoming more knowledge, labour and capital intensive, with higher risks that not unexpectedly limit the participation of smallholder farmers. While smallholder farmers do have a relative advantage in vegetable production where land is scarce and high labour requirements mean there are few economies of scale, production is often affected by the lack of inputs such as good quality seed and the misuse of inputs such as fertilisers and pesticides. Post-harvest losses are high and smallholders often lack appropriate processing technologies, market information and the ability to deal with the growing influence of supermarkets.

Packing cucumbers for the local market.

In the following plenary session, Dr. Greg Johnson provided a comprehensive overview of the industry, the crops, the value and outputs and the prevailing vegetable production systems practiced in the five focal countries (India, Indonesia, Thailand, the Philippines and Vietnam). To more fully realize the potential of the vegetable sector in Asia, it will be necessary to enhance profitability and competitiveness, facilitate a restructuring of the industry, enhance industry professionalism and market development, and to increase vegetable consumption. Jonathon Sutton, from Tesco Lotus, provided a very valuable insight into the purchasing and procurement strategies practiced by the world's fourth largest retailer. While quality and freshness, a competitive price, convenience and service are the key factors that influence the consumers' choice of retail store, food safety issues and concerns for the environment and worker welfare are increasing in importance.

Ably coached by Dr. Derek Eaton and Rolien Wiersinga, the five country case studies provided valuable insights into the reasons for and the impediments to the adoption of improved seed varieties. Not unexpectedly, an increased yield, improved quality and higher prices were the main reasons for adoption. Furthermore, reduced costs through greater resistance to disease and the need to apply chemicals less frequently provided a strong financial incentive. However, in most instances, adoption was contingent upon the availability of appropriate infrastructure, capital, information and technological support. While larger farms were more likely to adopt the innovation, the key underlying consideration was the farmer's propensity for risk.

Intensive capsicum production in a protected environment.

Invariably, for the majority of smallholder farmers, the key limitation was the high cost of improved seed, the lack of capital and the uncertainty in the output market. While prices in the wholesale market are determined by supply and demand, in much of tropical Asia supply is the more dominant factor. Irrespective of how much better the quality of the product may be as a result of using superior quality seed, prices will be determined by the quantity of produce available and often, the prices realised were insufficient to cover the increased cost of seed. The threat of natural catastrophes was always present and for many of the new varieties the threat of increased pestilence or the non suitability of the variety to the local conditions prevailed.

Problems such as these were abundantly evident, for only days before the proposed field tour, it was necessary to change the program as a result of viral disease and soil borne pathogens unexpectedly striking down the farmers' crops in the fields. Nevertheless, the contingency plan provided delegates with a welcome break and an ideal opportunity to see a little

A typical cucumber production enterprise in Chiang Mai.

more of Chiang Mai. In a number of visits to smallholder vegetable farmers, delegates were able to observe both the traditional cropping practices and an intensive farming operation producing capsicum in a protected cropping environment. A visit to East-West Seed experimental farm provided valuable insights into some of the latest techniques for the production and promotion of hybrid seed.

While there are no immediate plans for another symposium, the two day workshop did provide valuable information for an advocacy forum organised by the APSA and the Global Horticulture Initiative (GHI), which followed the symposium. Both the findings of this forum and the conference proceedings are expected to become available towards the end of the year.

In facilitating this symposium, the Organising Committee wishes to acknowledge the significant cash input made from East-West Seeds, who provided much of the seed money and sponsorship for the invited speakers, and the GHI, who provided much needed financial support for many of the participants from the region.

Peter J. Batt

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Commission Fruits and Vegetables and Health

FAV HEALTH 2007 - Int'l Symposium on Human Health Effects of Fruits and Vegetables

Participants of the Symposium.

From October 9 to 13, 2007, research scientists, industry representatives and professionals involved in the field of health effects of fruits and vegetables (F&V) met in Houston, Texas, United States of America for FAV Health 2007, the Second International Symposium on Human Health Effects of Fruits and Vegetables. This symposium was organized and hosted by the Vegetable and Fruit Improvement Center (VFIC) of Texas A&M University (http://vfic.tamu.edu), College Station, Texas, USA, in association with the International Society for Horticultural Science (ISHS), the American Society for Horticultural Science, and several academic institutions such as Baylor College of Medicine, Center for Obesity Research, Texas A&M University and the University of Texas at Dallas. Dr. Bhimu Patil was the Chair and Drs. Peter Murano, Marie Josèphe Amiot-Carlin and Yves Desjardins co-chaired the symposium.

The purpose of this conference was to provide a forum for horticultural scientists, nutritionists, dietitians, chemists, biochemists, food scien-

tists, clinicians, physicians and business personnel to exchange information and bridge the communication gap between agricultural sciences, nutrition and health sciences. The conference was attended by 300 participants representing 38 countries from 5 continents. Over two hundred and fifteen papers were given, including 120 plenary and regular presentations and 84 posters.

The conveners acknowledge the support of the organizing staff of the VFIC who conducted the event very professionally, as well as many academic and corporate sponsors without whom this Symposium would not have been possible. Special thanks are addressed to Texas A&M system for all their support.

In his opening remarks, Dr. Patil addressed the need for conveying the valuable message on health benefits of fruits and vegetables through discussion between health professionals and agriculturists. He mentioned the need of support from industries and funding agencies for carrying out such research. On behalf of ISHS, Dr. Desjardins expressed the interest of the Society to become an active player in the area of human health effects of fruits and vegetables. He also outlined the importance of creating a communication channel between scientists, ISHS, and other international organizations like FAO, WHO and others to have a better outreach to populations eager to obtain reliable information on nutrition and health related issues. FAV Health 2007 participants included scientists, industry and students and special attendees included global leaders such as WHO, NIH, USDA, FAO, NEPAD, Texas State Agricultural Commissioner, Texas State Comptroller, Texas A&M University System Chancellor, Vice Chancellor and Dean.

The scientific program was designed to provide attendees with various thematic presentations in different fields of expertise related to fruits and vegetables and health. Each session was started with a plenary session from expert personnel in the respective area. There were 21 sessions addressing some of the major diseases such as, cancer, cardiovascular disease, obesity, osteoporosis, brain and eye and skin health as well as the use of mineral elements for health benefits. Some sessions were related to pre- and postharvest and processing aspects such as, season, environment, breeding, growing conditions (organic) on health maintaining properties. Isolation, purification and characterization of bioactive compounds session addressed both research and industry issues on fruits and vegetables. Some of the unique sessions were wine and health, marketing of FAV, journal editors & professional societies. A round table discussion with policy makers, funding agencies, legislators, administrators and scientists was a successful event with strong interaction and Q&A from industry and scientists. A special dedicated graduate student luncheon was greatly appreciated by the participants. This session allowed four students from different countries to present their graduate research in 10 minutes and address the questions of other graduate students and the audience.

Each session was chaired by a distinguished scientist in the research area and/or industry representative as well as co-chaired by a graduate student. Co-chairing of a session by a graduate student was an unique opportunity to student community.

During the business meeting the activities of the working group on Human Health Effects of Fruits and Vegetables were updated. Plans have already been initiated by the Chair of FAV Health 2009, Dr. Marie Josèphe Amiot-Carlin, about the conference in France. FAV Health 2012 will be held at the University of Agricultural Sciences, Dhaward, India. Following officers were elected as FAV Health 2012 chairs: Dr. Mahadev Chetti (Chair) and Dr. Shivu Mantur and Dr. Vijakumar Hukkeri (Co-Chairs). The XXVIII International Horticultural Congress of ISHS in Portugal will coincide with FAV Health 2010 with a workshop related to FAV Health. In the meantime, symposium participants and all those interested in this topic will be able to continue their exchanges through a Listserv.

ISHS medal award. From left to right: Drs. Marie Josèphe Amiot-Carlin, Yves Desjardins, Bhimanagouda S. Patil and Peter Murano.

Bhimanagouda S. Patil

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Commission Quality and Post Harvest Horticulture
Europe-Asia Symposium on Quality Management in Postharvest Systems

The Quality Management in Postharvest Systems (EURASIA 2007) Symposium held in Thailand between 3 and 6 December 2007 at the Radisson Hotel, Bangkok, was organised by the Division of Postharvest Technology, King Mongkut's University of Technology Thonburi (KMUTT) under the auspices of the ISHS Commission Quality and Post Harvest Horticulture. This meeting was held concomitantly with the Quality Management in Supply Chains of Ornamentals Symposium (QMSCO 2007), organised by the same convener Dr. Sirichai Kanlayanarat and his active organising committees. These symposia were associated with the celebration on the auspicious occasion of His Majesty the King's 80th Birthday anniversary on December 5, 2007.

The main theme of the symposium was focused around quality management issues of fruits, vegetables, and ornamentals in the supply chains, but there were also presentations that touched upon consumer trends, sensory quality, packaging innovation, postharvest physiology and molecular biology, storage and transport technology, marketing and distribution system to improve quality and shelf life. These issues emphasised on dynamic demands for more research and future conferences on quality management in postharvest systems.

At the opening ceremony, Associate Prof.

ISHS information reported by Prof. P. Tonutti.

Kraiwood Kiatikomol, the President of KMUTT, welcomed 180 participants from over 30 countries to the symposium. Prof. Pietro Tonutti, the Chair of the ISHS Commission Quality and Post Harvest Horticulture, gave an update on ISHS activities and membership. The symposium brought together many eminent international scientists, extension personnel and students from a range of disciplines to discuss the development and innovations in quality management with the goal of supplying consistent quality of fruit and vegetables at a cost affordable to consumers in a global economy and still providing profits for others in the supply chain. It is generally accepted that there are many markets for high quality, healthy and safe fruit and vegetables from tropical and subtropical regions of the world, but there will be many challenges facing new entrants to international markets.

The first three days of the symposium were devoted to 18 keynote and invited speakers, 18 oral and 91 poster presentations on a diversity of topics including quality management in handling systems, physical treatments, storage and transport technology, pre- and post-harvest physiology and molecular biology, innovation packaging, and marketing and distribution systems. For the first keynote presentation, Prof. Errol Hewett emphasised the need for a fresh approach to be taken to provide appropriate tertiary education opportunities for young people required so that quality maintenance can be maximised in the postharvest supply chain sector, and provided information about the recent formation and activities of 'The Global Horticulture Initiative'. There was considerable discussion among the conferees on the trend for research needs in finding new storage and packaging technology and innovations that are more advanced than those used currently. An emerging trend with far reaching potential is the use of genetic tools for discovering and managing genes affecting produce quality. Dr. Ian Ferguson, New Zealand, provided an overview of the potential of this technology for development of new high quality varieties of fresh produce that involved a number of consumer-driven attributes of fresh produce including human health, nutritional properties, convenience and novelty. Valuable oral contributions were made on a diverse range of topics by well recognised postharvest scientists including Olaf van Kooten (The Netherlands), Wojceiech Florkowski (USA), Barry McGlasson (Australia), Bernard Bruechner (Germany), Paola Eccher-Zerbini (Italy), Pietro Tonutti (Italy), Yaron Sitrit (Israel), Efraim Lewinsohn (Israel), Ruth Ben-Arie (Israel), Jozef Streif (Germany), Art Cameron (USA), Ron Porat (Israel), Nehemia Aharoni (Israel), Miguel Vendrell (Spain), Harald Bolhar-Nordenkampf (Austria) and Christian Larrigaudiere (Spain). A large number of quality posters were on display and these generated lively discussion throughout the meeting. The potential and challenges for marketing Asian fruits and vegetables in Europe were addressed by Prof. Florkowski.

EURASIA participants on an excursion tour at 'Talaad Thai' market.

Thai cultural dance in the reception party performed by KMUTT students.

The final day of the symposium was a study tour to the largest wholesale market for fruit and vegetables in Thailand located at 'Talaad Thai' in the Pathumtani province; this was followed by a visit to a Thai handcraft centre in Ayudthaya.

Participants and accompanying persons were entertained at a welcome reception featuring wide varieties of Thai foods and Thai entertainment including a traditional Thai puppet show, classical music and dance performed by Thai students of the Division of Postharvest Technology, KMUTT. Many in the audience joined in the dancing with the students.

This Europe-Asia Symposium on Quality Management in Postharvest Systems is highly valued, exemplified by the number of international participants from many countries. It emphasised that postharvest technology by its nature is multidisciplinary and is clearly focused on maintaining product quality throughout the supply chain in an economically sustainable and environmental friendly way.

The proceedings of the symposium will be published in *Acta Horticulturae* in 2008. Copies of the proceedings will be available from ISHS.

Errol Hewett, Sirichai Kanlayanarat and Chalermchai Wongs-Aree

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New ISHS Members

ISHS is pleased to welcome the following new members:

NEW INSTITUTIONAL MEMBERS:

Area Srl, Italy and **Agri-Starts Inc.**, United States of America.

NEW INDIVIDUAL MEMBERS:

Argentina: Mr. Daniel Diéguez, Assist. Prof. Mariana Figini, Mr. Daniel Jeifetz; **Australia:** Mr. Phillip Berry-Porter, Mark Boersma, Ms. Christine Campbell, Mr. Ian Cummings, Ms. Jilushi Damunupola, Mr. Paul de la Motte, Mr. Kevin Handreck, Mr. Colin Jeacocke, Dr. Johann Joubert, Amanda Kingsley, Dr. Andrea Kodym, Mr. Gregory Lowe, Mr. Kim Martin, Ms. Penny Measham, Ms. Jennifer Morrison, Mr. Peter Morrison, Mr. Bevan Perkins, Mr. Greg Prendergast, Mr. Stephen Ridge, Mr. Mark Robinson, Dr. Peter Rogers, Mr. Philip Rowe, Mr. Kristjan Sorensen, Mr. Christopher Stacey, Mr. Malcolm Wallis, Michael Watkins, Ms. Elizabeth Wharton; **Austria:** Christian Kalcher; **Belgium:** Mr. Sven Clemens, Dr. Tom Eeckhaut, Dr. Sophie Renard, Dr. Cornelius Theo Speeleveld, Elke Van Kerckhove, Mr. Rudy Verhelst; **Benin:** Mr. Marius R.M. 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Mourão Fillho, Alexei de Campos Dianese, Fabiano de Carvalho Balieiro, Michelliny de Mattos Bentes Gama, Ebenézer de Oliveira Silva, Paulo Ricardo de Oliveira, Paulo Sérgio de Paula Herrmann Júnior, José de Ribamar Nazareno dos Anjos, Juliana Degenhardt, João Dimas Garcia Maia, Sérgio Delmar dos Anjos e Silva, Deborah dos Santos Garruti, Fernada Duarte Vidigal, Alberto Duarte Vilarinhos, Leonardo Dutra, José Geraldo Eugênio de França, Carlos Farley Herbster Moura, Marcos David Ferreira, Enilton Fick Coutinho, João Caetano Fioravanço, Alineaurea Florentino Silva, Rufino Fernando Flores Cantillano, Cleberson Freitas Fernandes, Mirtes Freitas Lima, Ossami Furumoto, Odílio Benedito Garrido de Assis, Luciano Gebler, Adonai Gimenes Calbo, César Luís Girardi, Tadeu Graciolli Guimarães, Maria Angélica Guimarães Barbosa, Dr. Andreia Hansen Oster, Ms. Eugenia Hidalgo, Nirlene Junqueira Vilela, Marília Locatelli, Daniela Lopes Leite, José Flávio Lopes, Ricardo Lopes, Francisco Célio Maia Chaves, Leonora Mansur Mattos, Caroline Marques Castro, José Francisco Martins Pereira, Francisco Marto Pinto Viana, Newton Alex Mayer, José Nilton Medeiros costa, Geraldo Milanez de Resende, Milza Moreira Lana, Alexandre Ortega, Henrique Pessoa dos santos, José Carlos Polidoro, Ana Cristina Portugal P. De Carvalho, Nelcimar Reis Sousa, Carlos Reisser Júnior, Henoque Ribeiro da Silva, Ana Cecília Ribeiro de Castro, Gilmar Ribeiro Nachtigall, Patrícia Ritschel, Maria das Graças Rodrigues Ferreira, Valter Rodrigues Oliveira, Eduardo Sanches Stuchi, Gustavo Schiedeck, José Ernani Schwengber, Marcos Silveira Wrege, Vicente Eduardo Soares de Almeida, Daniel Terão, Maria Rosa Travassos da Rosa Costa, Silvana Vieira de de Paula Moraes, Aldo Vilar Trindade, Nilton Tadeu Vilela Junqueira, Márcia Vizzotto; **Canada:** Shannon Buckshaw, Peter Candy, Robert Chesney, Mr. Mark Combellack, Mr. Jean-Paul Cote, Marie-Claude Desbiens, Dr. Guy Jobin, Ms. Salima Kassam, Mr. Patrick Legg, Mr. Brad McDonald, Mr. Cameron McKenzie, Dr. Kent Mullinix, Mr. Amin Osmani, Mr. Scott Pelton, Mahinsasa Tennakoon; **Chile:** Mr. Jose Cangas, Dr. Marigen Hornkohl Venegas, Prof. Matias Kulczewski, Nicolas Moller, Hugo Poblete, Ramiro Soffia; **China:** Mr. John Chapple; **Costa Rica:** Prof. Marco Cordoba; **Croatia:** Assist. 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Prof. John Wilking Einstein; **Indonesia:** Mr. Scott Martin; **Ireland:** Mr. Colman King; **Israel:** Dr. Saul Burdman, Yuval Chen, Prof. Avraham Lalazar, Mr. Guy Sela; **Italy:** Tania Baccigalupi, Prof. Dr. Remigio Berruto, Prof. Dr. Ernestina Casiraghi, Mara Falchi, Mr. Thierry Hautant, Mr. Patrick Syrbe; **Jamaica:** Prof. Norma Anderson, Mr. Yosuke Yaguchi; **Japan:** Mr. Alias Abdullah, Takaaki Ikeshiro, Dr. Haruhisa Inden, Mr. Berdiyar Jollibekov, Dr. Raham Sher Khan, Daiichiro Miyajima, Toshihiro Saito; **Kenya:** Dr. Violet Ongachi Kirigua; **Korea (Republic of):** Mr. Byoung Sup Ghill, Dr. Chee Hark Harn, Bung-Soo Kim, Mr. Suk Chon Lee, Mr. Hee-Sik Shin; **Malaysia:** Dr. Siti Hajar Ahmad, Mr. Wei Chong Goh, Prof. Dr. Rosna Mat Taha, Mr. Saravanan Subramaniyan; **Mexico:** Carlos Arteaga, Mario Berrios, Dr. Patricia Dupré, Hector Lujan, Aldo Mares, Mr. Adalberto Mustieles; **Morocco:** Dr. Messaoudi Zerhane; **Netherlands:** Dr. Venetka Agayn, John Bal, Vincent Bijman, Dr. Frank de Ruijter, Willem Evertse, Mr. Kevin Frediani, LiFu Liu, Christina Ms. Popma, Ms. Geeske Punt, Dr. Wessel van Leeuwen, Mr. Charle Wilfrid, Mr. Jun Yan; **New Zealand:** Greg Furniss, Ms. Cathie Harrison, Mr. Ian Power; **Nigeria:** Ms. Olubunmi Ibitoye, Dr. Ademola Adeseye Idowu; **Norway:** Mr. Valeri Andreev; **Pakistan:** Prof. Dr. Jehan Ara, Mr. Hadi Bux Laghari, Mr. Sohail Tareen; **Peru:** Mr. Carlos Bustamante, Mr. David Leon; **Poland:** Mr. Michal Majer, Dr. Agnieszka Marasek-Ciolakowska; **Portugal:** Dr. Florinda Gama, Dr. Maria Regina Menino, Prof. Jose Monteiro; **Romania:** Prof. Dr. Marin Ardelean, Assist. Prof. Silvana Mihaela Danaila-Guidea, Dr. Gabriela Teodorescu; **Russian Federation:** Dr. Tatiana Mitiouchkina; **Rwanda:** Mr. Celestin Ukozehase; **Saudi Arabia:** Prof. Dr. Abdulrahman Al-moshileh; **Singapore:** Mr. James Feng Khoo; **Slovenia:** Prof. Dr. Dea Baricevic; **South Africa:** Mr. Charl Le Roux, Mr. Trevor McKenzie, Mr. Michiel Prins, Mr. Andre Scholtz, Ms. Karen Swanepoel, Prof. Dr. Gert Venter; **Spain:** Mr. Daniel Arizpe, Antonio Arnillas, Dr. Xabier Barandiaran, Jose M Espada Lara, Ms. Saivin Gotz Quinn, Ms. Amelia Montoro, Dr. Jose Luis Muriel, Dr. Javier Rodrigo, J. Salieras, Mr. Gustavo Sandoval; **Sweden:** Thilda Ms. Nilsson; **Switzerland:** Dr. Juerg M. Grunder, Dr. Brian Wade; **Taiwan:** Mr. Chi-Chien Chou; **Tanzania:** Dazydelian Banda, Mr. Jerry Miner, Rudolf van Winkelhof; **Thailand:** Mr. Somnuk Sukjamsai, Dr. Tanya Tapingkae; **Turkey:** Ms. Mine Erdal Yavas, Dr. Nilda Ersoy, Ms. Berrin Hicyilmaz, Kadir Kaman, Mr. Avinash Mani, Assist. Prof. Yelda Ozden Tokatli, Assist. Prof. Elif Aylin Ozudogru; **United**

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In Memoriam

TREVOR ATKINS (1957-2008)

On February 11 2008 a tragic gliding accident caused the death of Dr. Trevor Atkins, long time Chairman, Secretary and dedicated supporter of the ISHS Working Group on Modelling in Fruit Research and Orchard Management.

Born in 1957 Trevor grew up in northern Ontario, Canada. In his student time, he first completed a degree in Forestry and then went on to do a PhD in Botany working on the ecology of wild rice. It must have been during this time when he met Julie Hall, whom he married in 1986. After finishing his PhD degree they moved to New Zealand in 1987. He changed topics from wetland ecology to lead the NZ Ministry of Agriculture and Fisheries group on biological modelling. Having experienced the evolving power of computers he was quick to use them for modelling and decision support systems. Understanding the biology, applying mathematical descriptions of key growth processes and then packaging this in an easy to understand way for growers and advisors became his aim. Consequently, free access for growers to weather station data nationwide and formulating growth curves for kiwifruit and apple growth were some of the main achievements during his time as part of the ministry. In 1992 he left public service and started his own private consulting company, HortVision. He was a member of the ISHS modelling working group from its beginning, he organized the group symposium in 1992 and, in the same year, took over as Chairman for the next 6 years. This was followed by supporting the group through the maintenance of the group's website and acting as Secretary. Imagine, all this while establishing a private consulting company, he had to live from.

Trevor Atkins

One of his key achievements was the development of the Orchard 2000 software package, a decision support software for fruit growers which was well ahead of its time. Again, combining biological understanding, mathematics and an intelligent packaging to support growers with their daily down to earth problems was the red line in his work.

Since 1994 he also discovered his love for gliding becoming a very experienced pilot and finally also a gliding instructor. With his tragic death we have lost a dedicated supporter, a warm, open and honest man whose energy and love for fun will be truly missed. Our thoughts and best wishes are with his family.

Peter Braun, Geisenheim Research Centre,
Section of Pomology, Geisenheim, Germany

Calendar of ISHS Events

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

YEAR 2008

- June 8-11, 2008, Toronto (Canada): **XI International Symposium on the Processing Tomato.** Info: Dr. Jane Graham, Ontario Food Processors Association, c/o Janisse Routledge, 7660 Mill Rd., Guelph, ONT N1H 6J1, Canada. Phone: (1)5197675594, Fax: (1)5197634164 or Mr. John Mumford, Ontario Vegetable Growers Marketing Board, 435 Consortium Court, NGE 258 London, Ontario, Canada. Phone: (1)519-681 1875, Fax: (1)519-685 5719 E-mail symposium: 2008worldcongress@opvg.org Web: http://www.worldtomato-congress.com/

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

- June 16-20, 2008, Matera (Italy): **XIV International Symposium on Apricot Breeding and Culture.** Info: Prof. Cristos Xiloyannis, Dip. Scienze dei Sistemi Colt., For., Amb., Viale dell'Ateneo Lucano, 10, 85100 Potenza, Italy. Phone: (39)3293606262, Fax: (39)0971205378, E-mail: cristos.xiloyannis@unibas.it E-mail symposium: apricot2008@unibas.it Web: http://www.unibas.it/apricot2008/home.htm

- June 16-17, 2008, Vignola, Modena (Italy): **II ISOFAR Conference on Organic Fruits & 16th IFOAM Organic World Congress.** Info: Dr. Franco Weibel, Res. Institute for Orgnic Farming, FIBL, Ackerstrasse, 5070 Frick, Switzerland. Phone: (41)628657272, Fax: (41)628657273, E-mail: franco.weibel@fibl.ch or Dr. Robert K. Prange, Agriculture and Agri-Food Canada, Atlantic Food and Horticulture Research Centre, 32 Main Street, Kentville, NS B4N 1J5, Canada. Phone: (1)9026795713, Fax: (1)9026792311, E-mail: pranger@agr.gc.ca Web: http://www.isofar.org/modena2008/fruit.html

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

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

- August 4-6, 2008, Bangkok (Thailand): **Asia-Pacific Symposium on Assuring Quality and Safety of Agri-Foods.** 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: aps2008@kmutt.ac.th Web: http://www.kmutt.ac.th/APS2008/

- August 4-8, 2008, Geneva, NY (United States of America): **IX International Symposium on Integrating Canopy, Rootstock and Environmental Physiology in Orchard Systems.** Info: Dr. Terence L. Robinson, Dept. Horticultural Science, 630 W. North Street, Geneva, NY 14456, United States of America. Phone: (1)315-787-2227, Fax: (1)315-787-2216, E-mail: tlr1@cornell.edu Web: http://www.nysaes.cornell.edu/hort/ishs/

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

- August 24-28, 2008, Brisbane (Australia): **VI International Symposium on In Vitro Culture and Horticultural Breeding.** Info: Prof. Acram Taji, QLD University of Technology, R Block, Faculty of Science, 2 George Street, GPO Box 2434, Brisbane, QLD 4001, Australia. Phone: (61)731386800, Fax: (61)731381508, E-mail: acram.taji@qut.edu.au Web: http://www.une.edu.au/cam-pus/confco/ivchb2008/

- August 25-28, 2008, Lima (Peru): **International Symposium on Soilless Culture and Hydroponics.** Info: Prof. Alfredo Rodriguez-Delfin, Univ. Nacional Agraria La Molina, Av. La Molina s/n, La Molina, Lima 12, Peru. Phone: (51-1)3495669, Fax: (51-1)3495670, E-mail: delfin@lamolina.edu.pe or Dr.Ir. P.F. Martinez-Garcia, Inst. Valenciano de Inv.Agrarias, Apartado Oficial, 46113 Moncada (Valencia), Spain. Phone: (34)963424000, Fax: (34)963424001, E-mail: pfmarti@ivia.es Web: http://www.lamolina.edu.pe/hidro-ponia/web2008/index.html

- NEW August 25-28, 2008, Fuzhou - Fujian Province (China): **III International Symposium on Longan, Lychee and Other Fruit Trees in Sapindaceae Family.** Info: Prof. Dr. Pan Dong-Ming, College of Horticulture, Fujian Agric & Forestry University, Dept. Of Horticulture, Fuzhou, Fujian Province, China. Phone: (86)59183789299, Fax: (86)59183735681, E-mail: pdm666@126.com or Prof. Dr. Qiu Donliang, College of Horticulture, Fujian Agriculture & Forestry University, Fuzhou, Fujian 350002, China. Phone: (86)591-83789284, E-mail: qiudl1970@yahoo.com.cn E-mail symposium: longan200808@yahoo.com.cn Web: http://www.longan2008.com/

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

- September 1-5, 2008, Gent (Belgium): **II International Humulus Symposium.** Info: Dr. Denis De Keukeleire, Ghent University, Laboratory of Pharmacognosy and Phytochemistry, Harelbekestraat 72, 9000 Gent, Belgium. Phone: (32)478369850 or 92648055, Fax: (32)92648192, E-mail: denis.dekeukeleire@ugent.be or 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 E-mail symposium: arne.heyerick@ugent.be Web: http://www.ishshumu-lus2008.ugent.be/

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

- September 8-12, 2008, Lillehammer (Norway): **V International Symposium on Brassicas and XVI Crucifer Genetics Workshop.** Info: Dr Magnor Hansen, Agricultural University of Norway, Dept. of Hort & Crop Science, PO Box 5022, N 1432 Aas, Norway. E-mail: magnor.hansen@umb.no E-mail symposium: brassica2008@umb.no Web: http://www.brassica2008.no/

- September 9-12, 2008, Sadovo (Bulgaria): **IV Balkan Symposium on Vegetables and Potatoes.** Info: Prof. Dr. Liliya Krasteva, Institute of Plant Genetic Resources, 2 Drujba Str., 4122 Sadovo, Bulgaria. Phone: (359)32629026, Fax: (359)32629026, E-mail: krasteva.liliya@gmail.com Web: http://www.4bsvp.org/

- September 9-13, 2008, Evora (Portugal): **VI International Symposium on Olive Growing.** Info: Prof. Dr. Anacleto Pinheiro, Universidade de Évora, Departamento de Engenharia Rural, Apartado 94, 7002-554 Évora, Portugal. Phone: (351) 266 760 837, Fax: (351)266 760 911, E-mail: pinheiro@uevora.pt or Dr. Manuel Pedro Fevereiro, ITQB, Quinta do Marques, Apt° 127, 2780 Oeiras, Portugal. Phone: (351)214469447, Fax: (351)214411277, E-mail: psalema@itqb.unl.pt Web: http://olivegrowing.uevora.pt

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

- September 21-25, 2008, Baoding (China): **I International Jujube Symposium.** Info: Prof. Dr. Mengjun Liu, Research Center of Chinese Jujube, Agricultural Univesity of Hebei, Baoding, Hebei, 71001, China. Phone: (86)312754342, Fax: (86)3127521251, E-mail: kjliu@hebau.edu.cn E-mail symposium: ijs2008@hebau.edu.cn Web: http://www.ziziphus.net/2008/

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

- NEW September 25-28, 2008, Beijing (China): **IV International Chestnut Symposium.** Info: Prof. Dr. Ling Qin, Beijing Agricultural College, No 7 Beinong Road, Changpin District, Beijing 102206, China. Phone: (86)1080799136 or 1080799126, Fax: (86)1080799004, E-mail: qinlingbac@126.com, chestnut2008@126.com Web: http://www.chestnut.org.cn

- October 5-8, 2008, Tbilisi (Georgia): **International Symposium on Current and Potential Uses of Nut Trees Wild Relatives.** Info: Dr. Zviad Bobokashvili, Georgian Res. Inst. Of Horticulture, Dept. Fruit &Vine Crop Germplasm Inv., Gelovani Street #6, Tbilisi 0115, Georgia. Phone: (995)93335793, E-mail: bobokashvili@gmail.com or Dr. Maya Marghania, Kostava 41, Tbilisi, Georgia. Phone: (995)99905076 Web: http://www.nutssymposium2008.ge/

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

- NEW October 14-17, 2008, Beijing (China): **II International Symposium on Vegetable Production and Quality and Process Standardization in Chain: a Worldwide Perspective.** Info: Dr. Wei Liu, Beijing Vegetable Research Center, Quality Control, PO Box 2443, Beijing 100097, China. Phone: (86)1051503003, Fax: (86)1088446286, E-mail: liuwei@nercv.com or Prof. Dr. Silvana Nicola, Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Via Leonardo Da Vinci 44, 10095 Grugliasco (TO), Italy. Fax: (39)0112368773, E-mail: silvana.nicola@unito.it Web: http://www.bvrc.com.cn/Vege2008Beijing/

- October 20-24, 2008, Tucson, AZ (United States of America): **International Workshop on Greenhouse Environmental Control and Crop Production in Semi-Arid Regions.** Info: Prof. Dr. Gene A. Giacomelli, University of Arizona, Controlled Environment Agric. Ctr., CEA Building, 1951 E. Roger Road, Tucson, AZ 85719, United States of America. Phone: (1)5206269566, Fax: (1)5206261700, E-mail: giacomel@ag.arizona.edu Web: http://www.ghwork-shoparidregions2008.org/

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

- November 3-7, 2008, Bogor (Indonesia): **IV International Symposium on Tropical and Subtropical Fruits.** Info: Dr. Roedhy Poerwanto, Jl. Abiyasa Raya No. 1, Bantarjati, 16143 Bogor, Indonesia. Phone: (62)251328942, Fax: (62)251326881, E-mail: roedhy@indo.net.id Web: http://www.ifs2008.info/

- November 4-7, 2008, Berlin (Germany): **Postharvest Unlimited 2008.** Info: Dr. Martin Geyer, Inst. für Agrartechnik Bornim, Abteilung Technik im Gartenbau, Max-Eyth-Allee 100, 14469 Potsdam-Bornim, Germany. Phone: (49)3315699610, Fax: (49)3315699849, E-mail: geyer@atb-potsdam.de Web: http://www.atb-potsdam.de/postharvest08

- November 8-13, 2008, Firenze, Faenza and Caserta (Italy): **IV International Symposium on Persimmon.** Info: Prof. Dr. Elvio Bellini, University of Firenze, Horticultural Department, Viale delle idee 30, 50019 Sesto Fiorentino, Italy. Phone: (39)0554574053, Fax: (39)0554574017, E-mail: elvio.bellini@unifi.it or Dr. Edgardo Giordani, Department of Horticulture, University of Florence, Viale delle Idee 30, 50019 Sesto Fiorentino)FI), Italy. Phone: (39)0 55 4574050, Fax: (39)0 55 4574017, E-mail: edgardo.giordani@unifi.it Web: http://www.4persimmon2008.it

- NEW November 9-14, 2008, Cape Town (South Africa): **WOCMAP IV: World Congress on Medicinal and Aromatic Plants.** Info: Prof. Dr. Kobus J.N. Eloff, Phytomedicine Programme, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa. Phone: (27)12-5298244, Fax: (27)12 5298525, E-mail: kobus.eloff@up.ac.za E-mail symposium: wocmap@up.ac.za Web: http://www.wocmap2008.com/

- November 10-13, 2008, Mérida (Mexico): **II International Symposium on Guava and other Myrtaceae.** Info: Dr. Wolfgang Rohde, MPIZ, Calf-von-Linné-Weg 10, 50829 Koeln, Germany. Phone: (49)2215062101, Fax: (49)2215062113, E-mail: rohde@mpiz-koeln.mpg.de or Dr. Jose Saul Padilla Ramirez, INIFAP-Campo Experimental Pabellon, Km. 32,5 Carr. Aguascalientes-Zacatecas, Apdo Postal No. 20 CP 20660, Pabellon de Arteaga, Aguascalientes, Mexico. Phone: (52)4659580167, Fax: (52)4659580167 Web: http://www.cicy.mx/eventos/guavasymposium2008/

- December 7-11, 2008, Chiang Mai (Thailand): **XVI International Symposium on Horticultural Economics and Management.** Info: Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au or Prof. Dr. Peter P. Oppenheim, Deakin Business School, Deakin University, 336 Glenferrie Road, Malvern, VIC 3144, Australia. Phone: (61)3 9244 5549, Fax: (61)3 9244 5040 Web: http://www.muresk.curtin.edu.au/conference/ishsem

- December 7-11, 2008, Chiang Mai (Thailand): **V International Symposium on Horticultural Research, Training and Extension.** Info: Peter J. Batt, Horticulture, Curtin University of Technology, GPO box U1987, Perth, WA 6845, Australia. Phone: (61)8 9266 7596, Fax: (61)8 9266 3063, E-mail: p.batt@curtin.edu.au or Associate Professor Dr. David Aldous, University of Melbourne, Burnley College, Swan Street, Richmond VIC 3121, Australia. Phone: (61)0392506800, Fax: (61)0392506885 Web: http://www.muresk.curtin.edu.au/conference/ishset

- December 8-12, 2008, Bangalore (India): **IV International Symposium on Acclimatization and Establishment of Micropropagated Plants.** Info: Dr. Jitendra Prakash, In Vitro International Pvt. Ltd., #12/44, Rajiv Gandhi Nagar, Bommanahalli, Bangalore 560 068, India. Phone: (91)80 41109273, Fax: (91)80 25727030, E-mail: invitro@bgl.vsnl.net.in Web: http://www.int-tissueculturecconf.org/

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

YEAR 2009

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

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

- NEW April 5-8, 2009, Leuven (Belgium): **I International Symposium on Cryopreservation in Horticultural Species.** Info: Dr. Bart Panis, Kasteelpark Arenberg 13, 3001 Leuven, Belgium. Phone: (32)16-321690, Fax: (32)16-321993, E-mail: bart.panis@biw.kuleuven.be or Prof. Rony Swennen, Lab. Tropische Plantenteelt, Kasteelpark Arenberg 13, 3001 Leuven, Belgium. Phone: (32)16321421, Fax: (32)16321993

- April 8-12, 2009, Antalya (Turkey): **VI International Postharvest Symposium.** Info: Dr. Mustafa Erkan, Dep. of Horticulture, Fac. of Agric. Akdeniz Univ., 07058 Antalya, Turkey. Phone: (90) 242 3102428, Fax: (90) 242 2274564, E-mail: erkan@akdeniz.edu.tr Web: http://www.postharvest2009.com/

- NEW May 20-24, 2009, Krokos, Kozani (Greece): **III International Symposium on Saffron Biology and Technology: Forthcoming Challenges in Cultivation, Research and Economics.** Info: Dr. Maria Tsimidou, Aristotle University Thessaloniki, Chemistry Department, Lab. FD Chemical Technology, 54124 Thessaloniki, Greece. Phone: (30)2310997796, Fax: (30)2310997779, E-mail: tsimidou@chem.auth.gr

- May 24-29, 2009, Gifu (Japan): **V International Symposium on Rose Research and Cultivation.** Info: Prof. Yoshihiro Ueda, Gifu International Academy of Horticulture, 1094-8 Shio, Kani-shi, Gifu Pref., Japan. Phone: (81)574605547, Fax: (81)574605547, E-mail: ueda-yoshihiro@horticulture.ac.jp E-mail symposium: rose2009@jecs.org Web: http://www1.gifu-u.ac.jp/~rose/index.html

- NEW June 9-13, 2009, Bologna (Italy): **II Conference on Landscape and Urban Horticulture.** Info: Prof. Dr. Giorgio Prosdocimi Gianquinto, Dip. Scienze e Tecnologie Agroambientali , DISTA, Università degli Studi di Bologna, Viale Fanin, 44 - 40127 Bologna , Italy. Phone: (39) 0512096641, Fax: (39) 0512096245 , E-mail: giorgio.gianquinto@unibo.it or Prof. Dr. Alessandro Chiusoli, Dept. DCA, via Fanin 46, 40127 Bologna, Italy. Phone: (39)051 2096446, Fax: (39)051 2096450, E-mail: alessandro.chiusoli@unibo.it E-mail symposium: dista.luh2009@unibo.it Web: http://www.luh2009.org

- June 14-19, 2009, Quebec City (Canada): **International Conference on Sustainable Greenhouse Systems - Greensys2009.** Info: Prof. André Gosselin, Université Laval, Pavillon ENVIROTRON, Ste-Foy (Quebec), G1K 7P4, Canada. Phone: (1)4186562131ext2068, Fax: (1)4186567871, E-mail: andre.gosselin@crh.ulaval.ca or Ms. Martine Dorais, Horticultural Research Center , Laval University, Envirotron Bldg, Room 2120, Quebec G1K 7P4, Canada. Phone: (1)418-6562131, Fax: (1)418-6567871, E-mail: doraisma@agr.gc.ca E-mail symposium: info@greensys2009.com Web: http://www.greensys2009.com/

- June 15-17, 2009, (Turkey): **I International Mulberry Symposium.** Info: Prof. Dr. Sezai Ercisli, Ataturk University Agricultural Faculty, Department of Horticulture, 25240 Erzurum, Turkey. Phone: (90) 442-2312599, Fax: (90) 442 2360958, E-mail: sercisli@atauni.edu.tr E-mail symposium: sercisli@hotmail.com

- NEW June 16-19, 2009, Saint-Pol de Léon (France): **VII International Symposium on Artichoke, Cardoon and their Wild Relatives.** Info: Christophe Bazinet, Bretagne Biotechnologie Végétale (BBV), Pen Ar Prat., 29250 Saint-Pol de Leon, Brittany, France. Phone: (33)298290644, Fax: (33)298692426, E-mail: bazinet@bbv.fr E-mail symposium: contact@bbv.fr

- NEW June 17-21, 2009, Ljubljana (Slovenia): **IV International Symposium on Breeding Research in Medicinal and Aromatic Plants. Biodiversity Conservation and Use of Genetic Resources.** Info: Prof. Dr. Dea Baricevic, University of Ljubljana, Biotechnical Faculty, Jamnikarjeva 101, 1000 Ljubljana, Slovenia. Phone: (386)41776653, Fax: (386)14231088, E-mail: dea.baricevic@bf.uni-lj.si

- June 22-26, 2009, Zlatibor (Serbia): **X International Rubus and Ribes Symposium.** Info: Prof. Dr. Mihailo Nikolic, Faculty of Agriculture, University of Belgr, 6 Nemanjina , 11080 Serbia Belgrade, Serbia. Phone: (381)63 801 99 23, Fax: (381)11 21 93 659, E-mail: mihailon@agrifaculty.bg.ac.yu or Brankica Tanovic, Pesticide & Environment Research Inst., 31b Banatska, 11080 Zemun-Belgrade, Serbia. Phone: (381) 11 31 61 773, Fax: (381) 11 30 76 133, E-mail: btanovic@bitsyu.net

- NEW July 29 - August 1, 2009, Corvallis, Oregon (United States of America): **International Symposium on Molecular Markers in Horticultural Species.** Info: Dr. Nahla V. Bassil, Plant Geneticist, Nat'l Clone Germplasm Repository, 33447 Peoria Road, Corvallis, OR 97331-23521, United States of America. Phone: (1)5417384214, Fax: (1)5417384205, E-mail: nahla.bassil@ars.usda.gov E-mail symposium: conferences@oregonstate.edu Web: http://oregonstate.edu/conferences/molecularmarkers2009/

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