Editorial

Welcome to dear readers,

It is a pleasure for me as Editor to be back in your hands, in this only digital format of our NUCIS Newsletter, started in the last NUCIS (issue 16) in May 2014. Three years after you have this new issue (17) of the digital NUCIS Newsletter, are thrilled because we can see this bulletin, with the effort of all of you, it is still well alive.

We are grateful to all contributors to this issue: to those who have written articles and those who have sent articles, reports and news of different symposia which have taken place during the last two years. In this issue, you will find articles on nuts in general (5) and specific for hazelnut (2) and almond (4). Contributions come from Argentina (2), Chile (1), Portugal (1), Spain (5) and Turkey (2). Some communications correspond to associations of the nut industry worldwide, Portugal, Argentina and Chile, were nut production interest is increasing in a significantly. We always endeavor to present the scientific development in all nut crops worldwide and we are also committed to cover a wide country representation, whenever possible.

Nut production revolution

In the last years nut production worldwide is experiencing a peaceful but deep revolution due to increasing demand. Nut consumption is booming due to human healthy related issues and thus prices rising. In a global nut market, only competitive producing orchards will succeed. A part from enough and scaled producing surfaces, technological improvement of orchards by using selected, high quality plant material and appropriate management is key to be competitive. In Mediterranean regions where most of this nut production is based water availability is scarce and at the same time a decisive
factor to be competitive and thus advanced irrigation technology for each crop (regulated deficit irrigation, RDI) is needed.

Activities 2014-2017

During these three years, different activities were supported by the FAO-CIHEAM Interregional Cooperative Research Network on Nuts. The 5th International Conference on Mediterranean Pines (Medpine5) was held in Solsona (Spain) in September 2014. Next year, in May 2015, the National School of Agriculture of Meknès (Morocco) hosted the XVI GREMPA Meeting on Almond and Pistachio, with a participation of more than 70 people coming from 10 different countries. The proceedings have been published and are available in internet (Options Méditerranéennes, Series A, no.119). A Meeting for the 1st EUFRIN Nut Tree Working Group was held in Budapest (Hungary), in November 2015. Finally, on May 2016, the Meeting of Agropine was organized in Oeiras (Portugal), and the proceedings will be published at “Options Méditerranéennes” during 2017.

In this NUCIS Newsletter 17, we inform also about different courses, events, prizes, magazines, etc. As you know, all activities related to nuts are welcome.

New books

We are glad to present you some new books on nuts edited recently.


Establecimiento de plantaciones clonales de Pinus pinea para la producción de piñón mediterráneo, (in Spanish), edited by INIA (Spain) (2016).


XVI GREMPA Meeting on Almonds and Pistachios, Options Méditerranéennes, Series A, no. 119.

Hazelnut Cultivars (in Turkish and in English), edited by .H.I. Balık, S.K. Balık, N. Beyhan and V. Erdogan. Klasmat

More details of these books are set in the “Books section”

FAO European Regional Office and CIHEAM (IAMZ)

Ms. F. Guerrero is our Regional representative of FAO Regional Office for Europe and Central Asia (REU) based in Budapest, Hungary. In relation to CIHEAM, Mr. A. López-Francos, placed at the Mediterranean Agronomic Institute of Zaragoza (IAMZ-CIHEAM), Spain is our representative.

The Nut Network on the web

Basic information is included in the REU website for ESCORENA (www.fao.org/world/regional/REU/content/escoprena/indexen.htm). More detailed information about the Nut Network can be found at http://networks.iamz.cieham.org/nuts/index.html

NUCIS on the web

A full electronic version of each NUCIS (From issue 1 to 17) is now available on the web page of the Nuts Network at http://networks.iamz.cieham.org/nuts/nuci_s_newsletter.html. The contents of this newsletter can be browsed through and also copied and printed. Readers will be able to find the whole set of NUCIS issues, some of which were already exhausted.

Contributions to NUCIS

The NUCIS Newsletter is published only in internet. The dissemination of information originated by the Network is of paramount importance and through this bulletin has been largely successful.

As in past NUCIS, we ask researchers on nuts, their collaboration in this newsletter, with articles, reports, news, notes, or any other information related to nuts. The pages of this bulletin are open to all readers who would like to suggest ideas or express their opinion about the work developed in the network or to publish short articles and reports on relevant horticultural subjects of general interest. Information should be sent well structured and clearly written in Standard English.

Contributions could be sent through Internet using the Scientific Editor’s e-mail. This bulletin is reproduced in black and white and the pictures in color. Please, send your contributions for the next issue, number 18, by the end of December 2018. We will try to edit a new number every two years. Finally, we thank all who have contributed to this issue, people publishing a short article, and people who have written reports of symposia conducted recently. To all of them thank you very much for your cooperation.

The Editor

CONTENTSS Page

EDITORIAL .................................................1

ARTICLES AND REPORTS

• Mediterranean nut tree production. an overview ......................................................3
• A new late blooming almond cultivar ..........9
• The origin of the almond ‘Guara’ ...............12
• On the origin of ‘Guara’ almond ...............16
• The almond in Argentina: evolution of crops and varieties in Patagonia .................18
• Organic production of nuts in Turkey ..........21
• Late spring frosts and its impact on Turkish hazelnut production and trade ............25
• New plantings of grafted hazelnut in Spain ...28
• The Norpatagonia Nuts Cluster ...............31
• CNCS the national centre of competences of dried fruits ..........36
• Chilenut: a successful example of an organization for the integral development of an industry ........................................35

NOTES AND NEWS

• Retirement of Dr Dunoxi Gabriá ................37
• “Ferrero hazelnut award contest” .............37
• A Prize of Recognition for Antonio J. Felipe and Rafael Socias i Company ............38
• Castanea, a journal on chestnut ...............40

CONGRESSES AND MEETINGS

• International Nut events in Argentina ........41
• AgroPine meeting within Medpine5, 2014 ...41
• XVI GREMPA Meeting on Almond and Pistachio, National School of Agriculture of Meknès. 12-14 May, Meknès. Morocco.....42
• The 1st EUFRIN Nut Tree Working Group Meeting..................................................44
• 2nd International meeting on Mediterranean stone pine for agroforestry – Agropine2016 45

TO BE HELD .................................................47
NEW BOOKS .............................................48
BIBLIOGRAPHY .........................................50
BACKPAGE .............................................55

FAO-CIHEAM - Nucis-Newsletter, Number 17, May 2017
MEDITERRANEAN NUT TREE PRODUCTION. AN OVERVIEW

INTRODUCTION
The spectacular and extended rise in nuts prices in recent years worldwide has the growers fostered new plantings. The pricing cycles for decades were based primarily on changes in supply. Bad growing conditions led to reduced crops and high prices, and good growing seasons coupled with increases in bearing surface led to declining prices. Demand is now the key driver of the market. Almond prices, as the main producing crop, are dragging market prices of the other nut crops. Consistent and strong consumption and high prices worldwide are driving the sector in the last five years.

In this review, four nut tree crops are considered: almond, hazelnut, pistachio and walnut. Although important in some Mediterranean countries, stone pine (Spain, Turkey, Portugal, Italy, etc.) and chestnut (Turkey, Italy, Greece, Portugal, etc.) are not included. Mediterranean nut production of the four species is growing steadily in recent years. Almond production is mainly based in Spain and hazelnut production in Turkey. Pistachio and walnut productions are more widely spread in most countries. New plantings of the four species are made every year and thus production will increase even more in the future.

The nut sector is growing in the Mediterranean countries due to increasing demand and high prices. Worldwide the nut market is both important and globalized. In addition, consumer health awareness is increasing and nuts have the added value of the Mediterranean healthy diet label and effects on human wellbeing.

In most Mediterranean large nut producing countries the sector is well organized and structured coexisting traditional and modern producing models. Nut industry and commerce are both strong and competitive in most countries. The development of the four crops showed similarities and differences. Statistical data on production and surface are mainly from FAO but also other sources (USDA, ABA; Spanish MA-GRAMA) have been used. Some insides on nut production in the Mediterranean countries per crop compared with trends worldwide and concluding remarks are presented following.

MEDITERRANEAN NUT PRODUCTION

Almond
World almond market is driven by the USA production. The successful almond marketing activities by the USA major industry players has opened new large almond markets (China and India mainly) and new uses worldwide (almond milk, etc.). This situation has led to increasing world almond demand which in 2013 surpassed offer (Figure 1). Increasing returns from orchards means high interest for the crop. The main nut tree worldwide is under a large technological improvement in Spain with some new 15,000-20,000 ha planted every year during the last few years. Almond orchards are placed under drip irrigation conditions in new irrigated areas or substituting several annual or perennial crops in old irrigated areas. Spanish new late-flowering, self-compatible and productive hard shell cultivars opened new production prospects for some frosty regions. Regarding new planting models, there is a tendency to reduce spacing and use new harvesting systems. It is important to highlight that mainly Spanish cultivars and rootstocks are being used to make new orchards. In some other Mediterranean countries like Morocco, Italy, Turkey, etc. the almond crop is also developing following the Spanish models and trends.

Almond producing surface in Mediterranean countries is about 1,200,000 ha and in the total World 1,600,000 ha (Figure 2). However, although almond surface is placed on Mediterranean countries, production is based outside (Figures 2 and 3). In the Mediterranean countries (71% of the total), with Spain leading with some 500,000 ha, orchards are mainly placed on rainfed conditions (Figure 4). However as almond production in the rest of the world is mainly situated under irrigated conditions, the Mediterranean almond surface is representing only the 15% of the total producing worldwide (Figure 5). The USA (California) is leading production by far followed by Australia, with a large increase in recent years and Spain (Figures 4). There are two types of almond shell: hard in Mediterranean countries and soft in the USA and Australia.
Hazelnut

World hazelnut prices are driven by Turkish annual production. However, hazelnut production is decreasing in Turkey due to improvement of living standards and tendency to abandon or unharvest wild plantings on mountain areas near the Black sea due to rural exodus. New crop technology is needed but evolving slowly. In Spain and to lesser extend in Italy, new orchards are planted using grafted trees on non-suckering rootstocks and using a single trunk training system. Scarcity availability of suitable grafted trees is affecting crop development. In addition, it is estimated that some 1,500 ha per year of new orchards are needed during the coming 5 years for the European industry. New cropping areas are slowly developing in northern Mediterranean countries (Georgia, Azerbaijan, etc.).

Hazelnut producing surface worldwide is about 600,000 ha and in the Mediterranean countries, where it is mainly focused, is 500,000 ha (Figure 6). Turkey is leading production by far, with some 425,000 ha orchards are mainly placed on rainfed conditions as in Georgia and Azerbaijan and irrigated in the rest (Italy, Spain, France, etc.) (Figure 7). Total world hazelnut production is following the Turkish pattern with some decrease in recent years. However as demand is strong Chile (new crop) and Oregon (traditional crop) in the USA are both planting new orchards in recent years (Figure 7). Hazelnut surface and production, in percentage are similar comparing Mediterranean countries and total world (Figures 8 and 9). In addition, each country produces mainly their own cultivars for two main uses: industry or table.

Pistachio

World pistachio prices are driven by Iranian and USA productions. Pistachio production is slightly increasing in Mediterranean countries. In Turkey, there is a large potential for new plantings in new irrigated areas in the south-eastern part (Anatolian region). In this country, mainly local cultivars are used. In Spain, lately some new inland areas are being planted using mainly Californian cultivars (nut splitting for snack). In Italy, Sicily, pistachio production based on ‘Bianca’ cultivar for industry (green kernel and non-splitting), is stable. Each country is using their own cultivars and only new producing areas are considering the new cultivar from California. Nursery production is scarce and trees are expensive. The pistachio crop in the Mediterranean countries needs to undergo large producing technological improvements. In addition, it needs improving crop management to avoid aflatoxins. The pistachio crop shows fair commercial prospects due to increasing consumption. It also shows large possibilities for nut industrialization.

Pistachio producing surface worldwide is about 500,000 ha and 130,000 ha (excluding Iran) in the Mediterranean countries (Figure 10). In the Mediterranean region, with Turkey and Syria leading and then Italy (Sicily), orchards are mainly placed on rainfed conditions. In Spain, some 8,000 ha have been planted in the last 30 years. Total world pistachio production is led by Iran and the USA (California) and then Turkey and Syria and other countries (Figures 11, 12 and 13). Figure 10. Pistachio surface (1000 ha) on Mediterranean countries versus total world production (Source: FAO)
Walnut

The walnut market is driven by the three major worldwide producers (China, Iran and the USA). Walnut production is also slightly increasing in most producing countries of the northern Mediterranean Basin (Figures 14 and 15). The technological level of production is high in most Mediterranean countries. However, the expansion potential is limited by the species high environmental requirements (fertile soils and large amount of water) and the scarcity of grafted trees due to large recent demands. Nursery grafted tree prices are also expensive. Mainly Californian cultivars are used except in frosty places where French cultivars are planted. The cultivar ‘Chandler’ is by far the most planted in the last ten years followed by ‘Howard’. Focusing mainly on one cultivar is causing some productive issues due to shrivelled kernels on very dry years. Walnuts are the first nut regarding highly reputed healthy claims.

Walnut producing surface worldwide is about 1,400,000 ha and almost 190,000 ha in the Mediterranean countries. In this region, France is leading followed by Turkey, orchards are mainly placed on irrigated conditions. In Spain, some 14,000 ha have been planted over the last 20 years with still young unbearing orchards. Chile is also developing a large and competitive walnut production in the last decades focused on exports. Comparing surface and production proportions between the Mediterranean region and the rest of the world they are similar (Figures 14, 15, 16 and 17).
CONCLUDING REMARKS

Nut tree production of the four species reviewed (almond, hazelnut, pistachio and walnut) has expanded largely in the last 20 years. Currently also, there is a major interest of growers and investors to plant new nut tree orchards worldwide and thus also in the Mediterranean Region due to considerable expected returns per surface. Nut trees are alternative crops for annuals (grain, forage, vegetables, etc.) and perennials (stone fruits, vineyards, citrus, etc.). This is due to several reasons, among others, full mechanization, easy storage, healthy issues, etc.

Within a context of climatic change and thus global warming and, under growing pressures as a result of the intensification of land uses and population growth, temperate nut trees show more resilience and potential adaptation than other temperate species to regions where environmental conditions are hardening over the years.

In Mediterranean countries, there is usually the issue of irrigated versus rainfed orchards due to scarce water availability in most growing areas. When water is scarce reduced drip irrigation (RDI) is a major breakthrough for increasing production. Production competitiveness is also an important issue and thus the cost of labour is a major factor and having large differences between producing countries affecting returns according to regions.

Some of these four species, mainly almond and pistachio can stand hard growing conditions (poor soils and limited water), however good yields can only be reached under suitable growing and managing conditions on irrigated land. Hazelnut and walnut require better soils and usually irrigated conditions depending on the annual rainfall.

Successful nut marketing worldwide has been a key to create and maintain the level of consumer demand needed to absorb an ever-increasing nut supplies at prices that have sustain the industry. In recent years the steady increase on nut production is being taken by new consumers (China and India) who are including nut intakes in their daily diets following healthy recommendations.

Organic farming of some of these four species is possible and demand is increasing. Nuts produced under organic conditions are reaching higher prices as demand is strong. Careful choice of cultivars is under organic farming even more important than on standard management. Organic breeding can play an important role in the future of this type of production.

In relation to plant material used, except on almond and to less extend on walnut most Mediterranean producing countries are using their own cultivars and rootstocks. Hazelnut crop is developing using Italian, Spanish or French cultivars according to the country. Walnut crop developing is based on Californian cultivars if risk of spring frost is reduced and on French cultivars if high, usually using J.
regia as rootstock but also several Juglans hybrids are started to be planted. Pistachio in Turkey, Greece and Italy are mainly based on their own country cultivars. Pistachio orchards in Spain are based in the Californian model instead.

In a global nut market conservation of the nut tree species' diversity is a main concern as demand is increasingly focusing on the only use of a reduced number of cultivars and rootstocks per each species. The existence and maintenance of germplasm Banks in some countries can be at least a solution. Conservation and characterization of these gene reservoirs has to be supported mainly by public funding. The potential use of this plants in future breeding can solve environmental or pest and disease issues. When breeding cultivars and rootstocks the use of a wide genepool and large capability in genomics and breeding technologies is essential to be successful. In addition, breeding should be focused on traits preferred by both producers and consumers.

Crop forecast yearly is also a major concern of the nut industry and the markets. Production estimations of the main nut tree crops are made every year in most important producing countries and are mainly based on observation. Nut markets are dependent on amount of available production and thus more forecast accuracy is needed. There is a field of research to develop more consistent methodologies on this important market issue.

The risk of aflatoxin contamination due to fungal nut proliferation is important in most nut crops. Aflatoxins are naturally occurring toxins produced by certain moulds of
the genus *Aspergillus* growing on some nut tree crops and other foods during production and storage. They can cause problems to health including cancer in animals and humans by damaging DNA. The EU sets limits for aflatoxin B₁ and for total aflatoxins (B₁, B₂, G₁ and G₂) in nuts. Regarding almond, although aflatoxin contamination is more important on soft shelled than hard shelled (bases of the Mediterranean production) it needs improved crop management and suitable postharvest technology and practices. The new trends on almond mechanical harvesting proposed for Mediterranean intensive new orchards, consisting in dropping nuts on the ground, and leaving for several days until drying before picking, could be risky, since in Mediterranean areas weather conditions can have some rain spells and are different than in dryer producing regions of the USA or Australia. In pistachio, aflatoxins are also an important aspect to be carefully controlled although Mediterranean pistachios (Turkey and Iran mainly) are less affected than USA pistachios due to lower rates of nut splitting and thus less potential risk of contamination.

Under the EU’s Food Information for Consumers (EUFIC) food manufacturers must label 14 allergens, tree nuts included among them. Allergies to tree nuts are common and have become an important health problem in both children and adults. The reasons of this increase in allergic reactions in developed and developing countries are largely unknown. Different genetic and environmental factors have been implicated. One of the possible explanations is the lack of allergens exposure. Allergic diseases are a group of complex and potentially serious disorders. Tree nuts allergic reactions are those produced by an immunological response. In addition, allergens and overuse of allergen warnings on food is putting consumers at risk. The risk of that allergenic consumers ignore the warning because it is used too much but sometimes there can be a high level of the allergen.

Regarding the research and development (R+D) context in most Mediterranean countries is currently stagnant. Innovation in almond (cultivars, rootstocks and planting systems) is mainly carried out in Spain. There is a limited innovation in hazelnut production technology (mainly on agronomy) and there is large interest from the chocolate industry on product innovation and production sustainability under fair trade and practices. In relation to pistachio and walnut plant material (new cultivars and rootstocks) and crop technology is depending from the USA, mainly University of California.

The Mediterranean nut production sector should be involved in funding R+D through implementing levy models (like in the USA or Australia). Levy models are based on contributions by growers per amount produced. As public funding to R+D is decreasing, we considered that this proposition is the way in which innovation can be supported in the future. Innovation is needed on nut trees plant material including resistance to pest and disease. Mechanical harvesting models are also important to be further developed regarding cost and environmental issues.

In some markets more local labelling for retail on nut tree products, where Italy is the most aware country, is feasible and recommended. Food manufactures are one essential partner to Mediterranean farmers. However we consider that local labelling, if decided, should be made on voluntary principles.

Global horticultural industry needs to address future challenges. Some can be considered as increasing global population, a growing middle class conscious of healthy food. Also changes in diets drive the demand towards more quality food in an environment of limited resources. In addition, increasingly, environmentally conscious consumers are seeking out supermarkets that sell only eco-verified products that have been sustainably produced.

**ACKNOWLEDGEMENTS**

This review is based on an oral presentation made at EXPO Milano 2015 by the first author. We are very grateful to the compilation, analyses and elaboration of dates made by M. Núñez from different data sources.

**REFERENCES**

Almond Board of Australia (ABA)  
www.australianalmonds.com.au

Dossier Frutos Secos, 34-37.


International Nut Council (INC). www.nutfruit.org


Food-Info.net: Overview of food-borne toxins–mycotoxins (aflatoxins)

European Mycotoxin Awareness Network (EMAN)

WHO Food Additives Series 40–JECFA monograph on aflatoxins

FAO Food and Nutrition Paper 81–Worldwide regulations for mycotoxins in food and feed 2003


I. Battle, M. Rovira, N. Aletà, A. Romero, X. Miarnau  
1IRTA Mas de Bover, Ctra. Reus-El Morell km 3,8, 43120 Constant, Tarragona, Spain.  
2IRTA Torre Marimon, 08140 Caldes de Montbui, Barcelona, Spain  
3IRTA Parc Científic i Tecnològic Agroalimentari de Lleida, Parc de Gardeny, Edifici Fruitcentre, 25003 Lleida, Spain  
E-mail: ignasi.battle@irta.cat
A NEW LATE BLOOMING ALMOND CULTIVAR

INTRODUCTION
The almond (Prunus amygdalus Batsch) breeding program of the CITA of Aragón aims to develop new self-compatible and late-blooming cultivars to solve the main problem detected in Spanish almond growing, its low productivity, due to the occurrence of frosts at blooming time or later and to a deficient pollination (Felipe, 2000). Now ‘Vialfas’ is being released because of its good horticultural and commercial traits, as well as its late-blooming time.

ORIGIN
‘Vialfas’ (selection I-3-27, clone 546) comes from the cross of ‘Felisia’, a self-compatible and late-blooming release of the Zaragoza breeding programme of small kernel size (Socias i Company and Felipe, 1999), and ‘Bertina’, a late-blooming local selection of large kernel size (Felipe, 2000). Consequently, ‘Vialfas’ is a full sib of ‘Mardía’. This cross was made with the aim of utilizing two late blooming almond cultivars, one of them carrying the late-bloom allele Lb (Socias i Company et al., 1999), of very different kernel size and genetically very distant, in order to avoid the problems related to inbreeding depression (Alonso and Socias i Company, 2007).

BLOOMING TIME
Blooming time has always been a very important evaluation trait in the CITA breeding program. As an average, ‘Vialfas’ blooming time is 22 days later than ‘Nonpareil’, 17 days after ‘Guara’, 10 days after ‘Felisia’, and three days before ‘Mardía’. The consistent late blooming time is due to very high chilling and heat requirements (Alonso and Socias i Company, 2006). Its S-allele genotype has been determined as Sps11 (Kodad and Socias i Company, 2008a).

PERFORMANCE
Field behavior has been evaluated with three grafted trees in an experimental plot and in six trees in three external trials. One on the most important points considered was the behavior in relation to spring frost injury. Especially important were the observations in 2003 and 2004, with severe frosts in most almond growing regions of Spain. Whereas cultivars considered as resistant to frosts such as ‘Guara’ (Felipe, 1988) suffered important yield reductions, ‘Vialfas’, due to its very late blooming season, did not suffer any damage (Kodad and Socias i Company, 2005).

Ripening time is early, about nine days later than ‘Guara’, the earliest ripening cultivar, thus allowing the succession of harvest. Nut fall before harvest has been very low, but nuts fell easily when shaken. Yield rating in a trial where different late-blooming cultivars and breeding selections were evaluated has been slightly lower than for ‘Guara’, 7.5 vs. 9 in a 0-9 scale (Alonso et al., 2015), considering that ‘Guara’ is a very high-yielding cultivar and rated as 9 in this scale (Alonso et al., 2012).

Table 1. Chilling and heat requirements of ‘Vialfas’ as related to other cultivars.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Chilling requirements (CU)</th>
<th>Heat requirements (GDH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desmayo Largueta</td>
<td>428</td>
<td>5,458</td>
</tr>
<tr>
<td>Marcona</td>
<td>428</td>
<td>6,603</td>
</tr>
<tr>
<td>Nonpareil</td>
<td>403</td>
<td>7,758</td>
</tr>
<tr>
<td>Belona</td>
<td>353</td>
<td>7,741</td>
</tr>
<tr>
<td>Soleta</td>
<td>340</td>
<td>7,872</td>
</tr>
<tr>
<td>Ferragnès</td>
<td>444</td>
<td>8,051</td>
</tr>
<tr>
<td>Guara</td>
<td>340</td>
<td>8,159</td>
</tr>
<tr>
<td>Felisia</td>
<td>329</td>
<td>9,465</td>
</tr>
<tr>
<td>Vialfas</td>
<td>503</td>
<td>10,066</td>
</tr>
<tr>
<td>Mardía</td>
<td>503</td>
<td>10,663</td>
</tr>
</tbody>
</table>

*Chilling units
*Growing Degree Hours in ºCelsius
The external trials have shown its good adaptation to different growing and weather conditions, maintaining a high level of bud density in all locations (Kodad and Socias i Company, 2008b). A trial in Aniñón (Zaragoza) at 730 m above sea level and of very cold climate has had good production even in years with late frosts. A trial in Caspe (Zaragoza), at 100 m above sea level and with a milder climate, has shown their very good production as well as vegetation. Although ‘Vialfas’ showed similar unshelled nut production than Guara’, the kernel production was slightly lower due to the lower shelling percentage of ‘Vialfas’ (Alonso et al., 2015). Blooming and ripening dates observed in these locations have been, as expected, earlier in Caspe than in Zaragoza, but later in Aniñón.

Tree vigor, shown as trunk cross sectional area (TCSA) is low. Consequently, it could be better adapted to high density plantings than more vigorous cultivars. As a result of this low vigor, ‘Vialfas’ is in the group of cultivars with the highest productivities, 86 g of kernel cm⁻² TCSA, similar to the most productive cultivar, ‘Guara’ (Alonso et al., 2015).

Nut and fruit evaluation has been done through seven years according to the IPGRI and UPOV descriptors. Nuts show a very good aspect and good size (4.7±0.5g), with a high number of small points, between elliptic and heart-shaped (Fig. 3).

---

**Table 2. Protein and fat composition of ‘Vialfas’ kernels as compared to other cultivars.**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Protein (% DW)</th>
<th>Oil (% DW)</th>
<th>Oleic acid (% oil)</th>
<th>Linoleic acid (% oil)</th>
<th>Oleic/linoleic acid ratio</th>
<th>Palmitic acid (% oil)</th>
<th>Stearic acid (% oil)</th>
<th>Palmitoleic acid (% oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Largueta</td>
<td>24.5</td>
<td>57.35</td>
<td>70.65</td>
<td>20.55</td>
<td>3.44</td>
<td>7.08</td>
<td>2.09</td>
<td>0.51</td>
</tr>
<tr>
<td>Marcona</td>
<td>23.8</td>
<td>59.10</td>
<td>71.75</td>
<td>19.40</td>
<td>3.70</td>
<td>6.15</td>
<td>2.09</td>
<td>0.52</td>
</tr>
<tr>
<td>Nonpareil</td>
<td>15.0</td>
<td>53.47</td>
<td>67.72</td>
<td>23.28</td>
<td>2.91</td>
<td>6.34</td>
<td>1.44</td>
<td>0.52</td>
</tr>
<tr>
<td>Belona</td>
<td>16.4</td>
<td>65.40</td>
<td>75.60</td>
<td>12.73</td>
<td>5.94</td>
<td>5.29</td>
<td>2.40</td>
<td>0.42</td>
</tr>
<tr>
<td>Soleta</td>
<td>20.0</td>
<td>61.80</td>
<td>69.20</td>
<td>19.70</td>
<td>3.51</td>
<td>6.40</td>
<td>1.65</td>
<td>0.60</td>
</tr>
<tr>
<td>Ferragnès</td>
<td>25.4</td>
<td>57.53</td>
<td>70.20</td>
<td>20.10</td>
<td>3.49</td>
<td>5.57</td>
<td>2.05</td>
<td>0.41</td>
</tr>
<tr>
<td>Guara</td>
<td>29.3</td>
<td>54.33</td>
<td>63.10</td>
<td>25.70</td>
<td>2.46</td>
<td>6.01</td>
<td>3.17</td>
<td>0.38</td>
</tr>
<tr>
<td>Felisia</td>
<td>27.0</td>
<td>56.32</td>
<td>68.05</td>
<td>22.10</td>
<td>3.08</td>
<td>5.90</td>
<td>1.75</td>
<td>0.60</td>
</tr>
<tr>
<td>Vialfas</td>
<td>18.8</td>
<td>57.37</td>
<td>77.97</td>
<td>12.32</td>
<td>6.33</td>
<td>5.70</td>
<td>2.48</td>
<td>0.58</td>
</tr>
<tr>
<td>Mardía</td>
<td>19.8</td>
<td>59.10</td>
<td>74.95</td>
<td>16.55</td>
<td>4.53</td>
<td>5.60</td>
<td>2.10</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Note: Dry weight.

**Table 3. Tocopherol composition of ‘Vialfas’ kernels as compared to other cultivars.**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>α-tocopherol (mg·kg⁻¹ oil)</th>
<th>γ-tocopherol (mg·kg⁻¹ oil)</th>
<th>δ-tocopherol (mg·kg⁻¹ oil)</th>
<th>Total tocopherol (mg·kg⁻¹ oil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Largueta</td>
<td>304.3</td>
<td>15.3</td>
<td>1.66</td>
<td>321.3</td>
</tr>
<tr>
<td>Marcona</td>
<td>463.3</td>
<td>18.5</td>
<td>1.87</td>
<td>483.7</td>
</tr>
<tr>
<td>Nonpareil</td>
<td>400.0</td>
<td>27.8</td>
<td>1.57</td>
<td>429.4</td>
</tr>
<tr>
<td>Belona</td>
<td>418.4</td>
<td>15.4</td>
<td>2.18</td>
<td>436.0</td>
</tr>
<tr>
<td>Soleta</td>
<td>214.0</td>
<td>13.3</td>
<td>1.51</td>
<td>228.8</td>
</tr>
<tr>
<td>Ferragnès</td>
<td>377.5</td>
<td>18.7</td>
<td>1.84</td>
<td>398.0</td>
</tr>
<tr>
<td>Guara</td>
<td>385.4</td>
<td>15.7</td>
<td>1.76</td>
<td>402.9</td>
</tr>
<tr>
<td>Felisia</td>
<td>250.6</td>
<td>18.2</td>
<td>1.73</td>
<td>270.6</td>
</tr>
<tr>
<td>Vialfas</td>
<td>222.5</td>
<td>14.0</td>
<td>1.53</td>
<td>238.0</td>
</tr>
<tr>
<td>Mardía</td>
<td>201.5</td>
<td>12.1</td>
<td>1.23</td>
<td>214.8</td>
</tr>
</tbody>
</table>

**Table 4. Phytosterol composition of ‘Vialfas’ kernels as compared to other cultivars.**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Kernel phytosterol content (mg·kg⁻¹ kernel)</th>
<th>Oil phytosterol content (mg·kg⁻¹ oil)</th>
<th>β-Sitosterol (% phytosterols)</th>
<th>Δ⁵-Avenasterol (% phytosterols)</th>
<th>Campesterol (% phytosterols)</th>
<th>Other phytosterols (% phytosterols)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Largueta</td>
<td>1445</td>
<td>2559</td>
<td>75.64</td>
<td>15.43</td>
<td>3.32</td>
<td>5.62</td>
</tr>
<tr>
<td>Marcona</td>
<td>2260</td>
<td>3515</td>
<td>74.69</td>
<td>13.95</td>
<td>2.11</td>
<td>9.24</td>
</tr>
<tr>
<td>Nonpareil</td>
<td>1891</td>
<td>3060</td>
<td>75.35</td>
<td>13.33</td>
<td>3.52</td>
<td>7.80</td>
</tr>
<tr>
<td>Belona</td>
<td>1848</td>
<td>3076</td>
<td>74.37</td>
<td>16.83</td>
<td>1.79</td>
<td>6.91</td>
</tr>
<tr>
<td>Soleta</td>
<td>1991</td>
<td>3321</td>
<td>68.44</td>
<td>22.40</td>
<td>1.80</td>
<td>7.37</td>
</tr>
<tr>
<td>Ferragnès</td>
<td>1911</td>
<td>2963</td>
<td>73.94</td>
<td>15.03</td>
<td>2.47</td>
<td>8.57</td>
</tr>
<tr>
<td>Guara</td>
<td>1506</td>
<td>2772</td>
<td>71.89</td>
<td>19.24</td>
<td>2.95</td>
<td>5.92</td>
</tr>
<tr>
<td>Felisia</td>
<td>1613</td>
<td>2792</td>
<td>69.72</td>
<td>17.74</td>
<td>3.64</td>
<td>8.91</td>
</tr>
<tr>
<td>Vialfas</td>
<td>1458</td>
<td>2589</td>
<td>68.65</td>
<td>19.35</td>
<td>3.36</td>
<td>8.63</td>
</tr>
<tr>
<td>Mardía</td>
<td>1531</td>
<td>2863</td>
<td>72.01</td>
<td>19.24</td>
<td>3.52</td>
<td>9.40</td>
</tr>
</tbody>
</table>

The external trials have shown its good adaptation to different growing and weather conditions, maintaining a high level of bud density in all locations (Kodad and Socias i Company, 2008b). A trial in Aniñón (Zaragoza) at 730 m above sea level and of very cold climate has had good production even in years with late frosts. A trial in Caspe (Zaragoza), at 100 m above sea level and with a milder climate, has shown their very good production as well as vegetation. Although ‘Vialfas’ showed similar unshelled nut production than Guara’, the kernel production was slightly lower due to the lower shelling percentage of ‘Vialfas’ (Alonso et al., 2015). Blooming and ripening dates observed in these locations have been, as expected, earlier in Caspe than in Zaragoza, but later in Aniñón.

Tree vigor, shown as trunk cross sectional area (TCSA) is low. Consequently, it could be better adapted to high density plantings than more vigorous cultivars. As a result of this low vigor, ‘Vialfas’ is in the group of cultivars with the highest productivities, 86 g of kernel cm⁻² TCSA, similar to the most productive cultivar, ‘Guara’ (Alonso et al., 2015).

Nut and fruit evaluation has been done through seven years according to the IPGRI and UPOV descriptors. Nuts show a very good aspect and good size (4.7±0.5g), with a high number of small points, between elliptic and heart-shaped (Fig. 3).
The shell is hard, adapted to the Spanish industry, with low shelling percentage (25%). However, the kernel percentage over the total fruit dry weight (DW) is 22.1%, quite high when compared with other cultivars: 23.1% for ‘Guara’, with the highest kernel percentage, and slightly less than 10% for ‘Marcona’, ‘Desmayo Largueta’ and ‘Nonpareil’ (Alonso et al., 2012). Kernels also show a very good aspect and good size (1.2±0.2g), heart-shaped, without double kernels (Fig. 3). In industrial cracking has been carried out by the Cooperative “Frutos Secos Alcañiz” and has shown very good results, despite the presence of double layers in the shell.

The chemical composition of the kernels has been determined in order to establish their best utilization opportunities. The content in protein is low and that of oil is medium, similar to that of ‘Marcona’ (Table 2), a very interesting trait for “turrón” production. The percentage of oleic acid, that of higher quality for fat stability and nutritive value in the lipid fraction, is especially high (Kodad and Socias i Company, 2006) from the Spanish Instituto Nacional de Investigaciones Agroalimentarias, and the activity of the Consolidated Research Group A12 of Aragón. We appreciate the technical work of M.T. Espiau, J. Búbal and A. Escota, as well as the collaboration of the cooperative “Frutos Secos Alcañiz”, the growers of the external trials, mainly A. Rabinad and J.L. Sánchez, and the collaboration of J.L. Espada and P. Castañer (Servicio de Recursos Agrarios de Aragón) in the experimental orchards.

The amount of fiber in kernel is particularly high, as well that of ash, being in both cases close to the highest amount of all cultivars analyzed (Table 5). Likewise the presence of mineral elements is very high for K and Ca, and average for Mg (Table 5).

ACKNOWLEDGMENTS

The long-term work to develop this cultivar has been funded by successive research grants, most recently RTA2014-00062-00-00 from the Spanish Instituto Nacional de Investigaciones Agroalimentarias, and the activity of the Consolidated Research Group A12 of Aragón. We appreciate the technical work of M.T. Espiau, J. Búbal and A. Escota, as well as the collaboration of the cooperative “Frutos Secos Alcañiz”, the growers of the external trials, mainly A. Rabinad and J.L. Sánchez, and the collaboration of J.L. Espada and P. Castañer (Servicio de Recursos Agrarios de Aragón) in the experimental orchards.

REFERENCES


Table 5. Mineral composition of ‘Vialfas’ kernels as compared to other cultivars.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fiber (% DW)</th>
<th>Ash (% DW)</th>
<th>K (% DW)</th>
<th>Ca (% DW)</th>
<th>Mg (% DW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Largueta</td>
<td>4.74</td>
<td>3.39</td>
<td>0.84</td>
<td>0.23</td>
<td>0.29</td>
</tr>
<tr>
<td>Marcona</td>
<td>4.39</td>
<td>3.09</td>
<td>0.75</td>
<td>0.19</td>
<td>0.28</td>
</tr>
<tr>
<td>Belona</td>
<td>4.43</td>
<td>2.67</td>
<td>0.82</td>
<td>0.10</td>
<td>0.26</td>
</tr>
<tr>
<td>Soleta</td>
<td>4.78</td>
<td>2.76</td>
<td>0.78</td>
<td>0.18</td>
<td>0.22</td>
</tr>
<tr>
<td>Ferragnès</td>
<td>5.60</td>
<td>3.46</td>
<td>0.86</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Guara</td>
<td>4.58</td>
<td>3.28</td>
<td>0.85</td>
<td>0.25</td>
<td>0.28</td>
</tr>
<tr>
<td>Felisia</td>
<td>5.25</td>
<td>3.10</td>
<td>0.85</td>
<td>0.21</td>
<td>0.24</td>
</tr>
<tr>
<td>Vialfas</td>
<td>5.56</td>
<td>3.38</td>
<td>0.87</td>
<td>0.28</td>
<td>0.25</td>
</tr>
<tr>
<td>Mardía</td>
<td>5.54</td>
<td>3.17</td>
<td>0.86</td>
<td>0.29</td>
<td>0.24</td>
</tr>
</tbody>
</table>

zDry weight

Fig. 3. Nut and kernel of ‘Vialfas’.
THE ORIGIN OF THE ALMOND ‘GUARA’

ABSTRACT
‘Guara’ has been the most widely planted almond cultivar in Spain recently. The introducers of this cultivar reported its origin as unknown and suggested that was related to the Italian cultivar ‘Tuono’. Indeed, farmers and researchers experience revealed close pomological similarities between ‘Guara’ and ‘Tuono’. In order to compare the identity of the two cultivars, their genetic profiles (fingerprints) were determined with a set of 12 molecular markers (type microsatellites, SSR) used to analyze the INRA clones of ‘Guara’, ‘Tuono’, ‘Supernova’ and ‘Mazzetto’, the two last considered synonyms of ‘Tuono’. In addition, a set of 23 SSRs was also analyzed in ‘Guara’ and ‘Tuono’ samples from different almond reference collections of CEBAS-CSIC (Murcia, Spain), INRA (Avignon, France), IRTA (Constanti, Spain), and the University of Bari (Bari, Italy). The results confirmed that ‘Guara’ and ‘Tuono’ present identical DNA fingerprints for the 35 SSRs analyzed. This information together with its unknown origin and the similar agronomic traits of the two cultivars, demonstrates that ‘Guara’ is identical to ‘Tuono’.

Keywords: Almond, Prunus dulcis, Self-compatibility, Cultivar identification, Molecular markers, Microsatellites, SSRs

INTRODUCTION
The almond (Prunus dulcis Mill.) ‘Guara’ has been the most widely planted cultivar in Spain until recently (1996-2010), representing almost 40% of all new plantations (Socias i Company et al. 2008; 2011; Socias i Company and Couceiro, 2014). Its extensive use can be attributed to its fair agronomic performance, given that it was the first self-compatible late flowering cultivar available. In addition, crop development plans helped planting this variety, despite its intermediate vigour and productivity, slightly bitter kernel flavour, susceptibility to various fungus diseases and the significant percentage of chardons in southern Italy are planted with ‘Guara’ that it was the first self-compatible late flowering cultivar available. Currently, most of the new almond orchards in southern Italy are planted with ‘Tuono’. ‘Guara’ was registered in the “Spanish Register of Protected Varieties” in 2003, and later cancelled in 2012 (Boletín Oficial del Estado Español, 2003 and 2012), despite the wide dissemination of the cultivar in Spain during the nine years under registration (Socias i Company et al., 2012, Socias i Company and Couceiro, 2014). For a long time, researchers, technicians and farmers have observed similar traits and agronomic behaviour in ‘Guara’ and the Italian cultivar ‘Tuono’ (flowering time, self-compatibility, productivity, ripening time, tree vigour, fruit shape, fruit flavour and fungus disease susceptibility) (Grasselly and Duval 1987, Navarro 2002, Muncharaz 2004, Arquero et al., 2008, Arquero 2013). For this reason, together with the unknown origin of the cultivar, different researchers have suspected that ‘Guara’ might be the native Italian ‘Tuono’.

‘Tuono’ is one of the most important local varieties in Italy. It first spread in Apulia around 1830, in the territory of Trinitapoli (Foggia province), where it was the only cultivar grown (Pantanelli and Fanelli, 1934). In 1970, this cultivar represented 10–40% of the plantations in these areas, depending on location (Grasselly and Crossa-Raynaud, 1980). It was later introduced to Greece where it is known as ‘Truoito’ (Stylianides, 1976) and to Libya and Tunisia where it is known as ‘Mazzetto’ (Grasselly and Olivier, 1976). Currently, most of the new almond orchards in southern Italy are planted with ‘Tuono’ due to its late blooming, self-fertility and wide environmental adaptability (Sottile et al., 2014). Interestingly, the cultivar ‘Supernova’, released as a self-compatible mutant of ‘Fasciello’, was found to be ‘Tuono’ (Marchese et al., 2008).

Unidad de Fruticultura, Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Av. Montañana 930, 50059 Zaragoza, Spain
E-mail: rsocias@cita-aragon.es


Unidad de Fruticultura, Centro de Investigación y Tecnología Agroali-mentaria de Aragón (CITA), Av. Montañana 930, 50059 Zaragoza, Spain
E-mail: rsocias@cita-aragon.es

FAO-CHEAM - Nucis-Newsletter, Number 17, May 2017

12
Since the first report of self-compatibility of some Apulian varieties (Grasselly and Olivier, 1976), including ‘Filippo Ceo’ first and then ‘Tuono’, this cultivar has long been used as a source of self-compatibility and late flowering in different European breeding programmes. These include those at INRA Avignon, France where is the progenitor of ‘Lauranne’, ‘Stellette’ and ‘Mandaline’), CITA Zaragoza, Spain (‘Aylés’, ‘Moncayo’, ‘Cambra’ and ‘Felisia’), CEBAS-CSIC Murcia, Spain (‘Antoñeta’ and ‘Marta’), and IRTA Constanti, Spain (‘Francolí’).

Currently, molecular markers such as SSRs (Simple Sequence Repeats) make it easy and economical to identify almond cultivars. In this species, a set of five selected SSRs have allowed to identify most varieties, even those coming from the same cross [(such as ‘Marta’, ‘Antoñeta’ and ‘Lauranne’, descendants of ‘Ferragnés’ × ‘Tuono’) (Sánchez-Pérez et al., 2006)]. In addition, for the identification of the Californian almond varieties, Dangl et al. (2009) used 12 SSRs to identify 18 almond cultivars.

Different SSR markers have been applied to the identification of ‘Guara’ and ‘Tuono’ by different groups who were unable to differentiate between both (Sánchez-Pérez et al., 2006; Gouta et al., 2010). Only the team from CITA Zaragoza reported that these varieties were similar but slightly different with 19 SSR markers and suggested that ‘Guara’ could have originated by self-pollination of ‘Tuono’ (Fernández i Martí et al., 2009).

The objective of this work was the molecular characterization of accessions of ‘Guara’ and ‘Tuono’ cultivars from four different germplasm collections in France, Spain and Italy based on an analysis of 35 SSRs, including those analysed by Fernández i Martí et al. (2009), in independent laboratories. The aim of this characterization is only to determine if ‘Guara’ and ‘Tuono’ are the same or different cultivars clarifying their origin and identity. This work is based on Dicenta et al. (2015) and tries to help almond choice disregarding any other misconsideration.

**MATERIALS AND METHODS**

Leaf samples of ‘Guara’ and ‘Tuono’ (together with ‘Mazzetto’ and ‘Supernova’, synonyms of ‘Tuono’) were picked from the INRA Avignon collection for the analysis of 12 SSRs in the Avignon laboratory (Table 1). In addition, leaves were collected from the almond collections of CEBAS-CSIC (Murcia, Spain), INRA (Avignon, France), IRTA (Constanti, Spain) and, the University of Bari (Bari, Italy). Leaf samples, identified with a code, were sent to the Genetic Analysis Service of CRAG (Barcelona, Spain) for analysis with a set of 23 SSRs (Table 2).

**SSR analysis**

In both laboratories, INRA and CRAG, DNA was extracted using the CTAB method according to Doyle and Doyle (1987) but scaled down to a 1.5 ml tube format. A total of 35 SSRs were analysed (Tables 1 and 2), including all the SSRs assayed by Fernández i Martí et al. (2009), which are indicated in Table 2 with asterisks. DNA fragment separation was performed in an ABI Prism 3130xl automated sequencer (PE/Applied Biosystems).

**RESULTS**

Table 1 shows the allele sizes of 12 SSR markers for ‘Guara’, ‘Tuono’, ‘Supernova’ and ‘Mazzetto’ from the INRA collection. All cultivars presented identical fingerprints for all of the 12 SSRs used.

Table 2 shows the size of the SSR alleles of the 23 markers assayed in the analysis of the ‘Tuono’ and ‘Guara’ samples from the different germplasm banks of CEBAS-CSIC, INRA, IRTA and the University of Bari. Both ‘Guara’ and ‘Tuono’ presented identical DNA fingerprints for all 23 SSRs.

**DISCUSSION**

The results showed this technique usefulness for the identification of almond genotypes. Only BPPTC018 did not show amplification. Similarly, Shiran et al. (2007), analysing a large number of wild and cultivated almonds (‘Tuono’ included), did not observe amplification with this SSR.

Our results confirmed previous work by other authors indicating the similar DNA fingerprints of ‘Tuono’ and ‘Guara’ (Sánchez-Pérez et al., 2006; Gouta et al., 2010). Sánchez-Pérez et al. (2006) assayed six SSRs in 21 almond cultivars, including ‘Guara’ and ‘Tuono’, using three different SSR polymorphism analysis methods, a capillarity sequencer, polyacrylamide electrophoresis, and Metaphor® agarose electrophoresis. Results showed that the DNA fingerprints of ‘Guara’ and ‘Tuono’ were identical except for one SSR marker (pchgms3) analysed using agarose electrophoresis, showing the limitations of this technique in the analysis of polymorphisms. Gouta et al. (2010), assaying 10 SSRs in 82 almond genotypes, also described a high genetic similarity (GS) of 0.90 between ‘Guara’ and ‘Mazzetto’ (synonym of ‘Tuono’) and these clustered with ‘Supernova’ at a genetic similarity of 0.84.

Marchese et al. (2008), using SSR analysis, had previously shown that ‘Supernova’ was actually ‘Tuono’. Later, in a genetic diversity study of Italian varieties, Distefano et al. (2013) also found ‘Supernova’ and ‘Tuono’ to be identical. We reached the same conclusions, confirming that ‘Supernova’ and ‘Mazzetto’ have the same genetic profile as ‘Tuono’ and ‘Guara’. Furthermore, Martins et al. (2003), using six RAPD (Random Amplified Polymorphic DNA) markers and five ISSR (Internal Simple Sequence Repeats) markers, found that ‘Guara’ was associated with ‘Tuono’, clustering independently from other 51 almond cultivars assayed.

| Table 1. Size of alleles obtained in the analysis of 12 SSRs in samples of the almond ‘Guara’, ‘Tuono’, ‘Mazzetto’ and ‘Supernova’ from INRA Avignon. For the four cultivars, the alleles of all SSRs were identical. |
|---|---|---|
| **SSR markers** | **Reference** | **Alleles size** |
| BPPTC010 | Dirlewangner et al., 2002 | 139/160 |
| BPPTC027 | Dirlewangner et al., 2002 | 241/249 |
| BPPTC036 | Dirlewangner et al., 2002 | 248/250 |
| CPDCT005 | Mneja et al., 2005 | 101 |
| CPDCT034 | Mneja et al., 2005 | 172/173 |
| CPDCT035 | Mneja et al., 2005 | 142/154 |
| pchgms1 | Sosinski et al., 2000 | 184/203 |
| pchgms3 | Sosinski et al., 2000 | 173/175 |
| UD96-003 | Cipriani et al., 1999 | 100/104 |
| UD96-013 | Cipriani et al., 1999 | 140 |
| UD96-018 | Cipriani et al., 1999 | 231/235 |
| UD98-408 | Cipriani et al., 1999 | 101 |
Another significant similarity between ‘Guara’ and ‘Tuono’ is their identical incompatibility genotype for the S locus ($S_1S_f$) (Ortega et al., 2005; López et al., 2006; Kodad et al., 2008).

In addition, studies in field conditions looking at the whole tree have demonstrated the similar agronomic behaviour of both cultivars, including the same flowering and ripening time, frost resistance, similar productivity, high susceptibility to Phomopsis and other almond collection in Spain (Felipe, 2016). Later, CIT researchers cleaned this cultivar by thermotherapy and observing its self-compatibility and agronomic performance (Socias i Company and Felipe, 1992), registered ‘Guara’ as a new cultivar in 2003. This is confirmed by Felipe (2016) in this issue.

In conclusion, fingerprinting with 35 SSRs, including the 19 SSRs used by Fernández i Martí et al. (2009), of leaf samples from four different germplasm collections in France, Italy and Spain, showed the identical fingerprints of ‘Guara’ and ‘Tuono’. These genotypes, together with the fact that ‘Guara’ and ‘Tuono’ share the same self-incompatibility alleles, similar agro-nomical characteristics and the same fatty acid profile, and the unknown origin of ‘Guara’, confirm that ‘Guara’ is identical to ‘Tuono’.

ACKNOWLEDGMENTS

This study was financed by the project “Almond breeding” by the Spanish Ministry of Economy and Competitiveness. We thank Dr. Werner Howad from CRAG, Barcelona, for advice and technical support with marker analysis and interpretation. We would like also to state that this work has only the purpose to clarify the origin of ‘Guara’ almond and not to discredit the work carried out by A. J. Felipe for whom we have a large respect as breeder and pomologist.

REFERENCES


Department of Plant Breeding, CEBAS-CSIC, PO Box 164, 30100 Espinardo, Murcia, Spain. E-mail: tdicenta@cebas.csic.es.

IPTA Mas de Bover, Ctra. Reus-El Morell km 3,8, 43120 Constanti, Tarragona, Spain.

IRTA Parc Cientific i Tecnologic Agroalimentari de Lleida, Parc de Gardeny, Edifici Fruitcentre, 25003 Lleida, Spain.

Dipartimento di Scienze del Suolo, della Planta e degli Alimenti (DISPA). University of Bari, Bari, Italy.

INRA, UR1052, Génétique et Amélioration des Fruits et Légumes, Domaine St Maurice, F-84143, Montfavet, France.

ON THE ORIGIN OF ‘GUARA’ ALMOND

Dicenta et al. (2015) have recently published in “Scientia Horticulturae” an article on the origin of the almond ‘Guara’. The authors are making some considerations affecting more or less directly to my work during my dedication as a researcher and to the results I obtained. Therefore, I feel myself obliged to make some precisions to clarify some points before judging the results presented by the authors.

First I would like to remind that ‘Guara’ was put freely available for the growers in the years 1980s as a result of a clonal selection in the SIA of Zaragoza (now CITA of Aragón). It was introduced in our collection in 1970 under the name ‘Cristomorto’ from the collection established by Ramon Vidal-Barraquer in Tarragona and identified in our records as 121. This origin was clearly stated in the first description of ‘Guara’ (Felipe and Socias i Company, 1987) and in my book (Felipe, 2000):

‘GUARA’

Origin: It comes from a clonal and sanitary selection carried out at the Unidad de Fruticultura of the Servicio de Investigación Agraria of Zaragoza from a variety introduced under an erroneous name.

At the same time ‘Tuono’ was introduced from the same collection of Ramon Vidal-Barraquer in Tarragona and was identified in our records as 124. ‘Tuono’ was also introduced later in several occasions from different origins, including that of the French INRA and the Oreo nursery. However, after stating, with the tools then available, that all ‘Tuono’ introductions were probably the same, only the 124 genotype was maintained. Similarly, it was also concluded that clone 121 did not correspond to the description of ‘Cristomorto’ and to its identity when this cultivar was also introduced from other origins.

Genotypes 121 and 124 have been maintained in the National Almond Repository since then and our observations showed some differences.
between them, such as in frost tolerance and percentage of double kernels, despite a high level of similarity for many morphological traits. Genotype 121 attracted our attention because of its constant productivity, kernel quality, early ripening and frost resistance, thus considering that it required a closer examination.

It was soon discovered that clone 121, as well as ‘Tuono’ and many other introductions, was affected by several viruses. R. Gella, in charge of the virus studies in our department, applied thermotherapy sanitation to clone 121, obtaining a clean clone, from which all future propagations were made. Consequently, we have always stated that ‘Guara’ came from a clonal and sanitary selection.

After verifying that the virus sanitation did not negatively affect the positive traits of clone 121, it was studied in our department, mainly in order to state its set ability both after self- and cross-pollinations, showing its autogamy. It was also tested in commercial orchards thanks to the offer of some growers. The agronomical behaviour was always satisfactory, since this clean clone 121 produced a crop in years when other cultivars lost their crop after heavy frosts, especially when compared with the traditional early-blooming Spanish cultivars.

This was clearly shown in an orchard at Peñaflor, near our Research Station. It was a non-irrigated orchard consisting of traditional Spanish cultivars and nearly unproductive. After topworking with ‘Guara’, this orchard became highly productive according to its conditions, maintaining this productivity since then.

All these results suggested that this clean clone had very interesting traits for the Spanish almond growing conditions, characterised by late spring frosts, pollination deficiencies, and other awkward conditions, despite it showed some negative traits, such as the presence of double kernels and sensitivity to some fungal diseases. These negative traits, however, did not really affect its good productivity and economical benefit for the growers.

Considering these advantages over the traditional Spanish cultivars, and not knowing the real name of clone 121 and its origin, we decided to give to this clone a name and as such it was included in the Spanish register of commercial cultivars. It was not protected but put at the free disposal of the Spanish almond sector. Probably as a consequence of being a free cultivar of outstanding performance it was re-grafted on old almond trees in a large amount, not included in the statistics of trees produced by the Spanish nurseries. As a consequence of being a free variety, neither the Institutes nor the authors involved in its release have ever obtained an economical benefit as a royalty coming from its propagation.

We have never hidden the origin of ‘Guara’, having received a new name because it came through the selection of a previous genotype of unknown name. All the selection process was included in different research projects funded by INIA and SIA, Institutes receiving the pertinent research reports according to the evolution of the work. It is convenient to recall that ‘Guara’ is highly appreciated by the growers due to its autogamy, productivity, frost resistance and early ripening. Due to this outstanding performance, it has inspired the other almond breeding programmes in Spain. Probably the success of ‘Guara’ induced the incorporation of self-compatibility as an objective by other breeding programmes, which undoubtedly are trying to improve it.

In any case, if ‘Guara’ was identical to ‘Tuono’, is it a real problem? It would be a selected clone of ‘Tuono’ and this would not affect its quality neither its ability to satisfy the need of the growers. In fact, several morphologically different genotypes have been called ‘Tuono’ according to the description of different almond repositories. Does it affect the results of growing ‘Guara’? Some more questions could be put in relation to its origin:

The fact that ‘Guara’ could be a select clone of ‘Tuono’ would reduce the benefits obtained by the growers without causing any harm to anybody?

Does it represent a fraud in the task of a researcher trying to solve the problems of the Spanish almond growing, as clearly shown by the results obtained in growing it? In doing that did we commit an outrage?

The merit that ‘Guara’ has solved, at least partially, the serious problems of almond production in our Mediterranean conditions may be denied?

In any case, ‘Guara’ was a new clean clone of almond and as such deserved to receive a name and be propagated as such to maintain its identity. Therefore, it seems incomprehensible that whereas the Spanish almond sector recognizes the success of this cultivar because we tried to solve the problems of this sector, some other researchers are trying to discredit that work arising doubts about its identity and origin.

As a consequence, the insinuation that ‘Guara’ is the result of a fraudulent process shows a real ignorance about the origin of this cultivar and tries to instill doubts on our sane intention and moral duty to provide the growers a more efficient plant material than that previously grown, reaching with it a full revolution in the Spanish growing sector.

Dicenta et al. (2015) did not pay sufficient attention to the origin of ‘Guara’ and did their work without a proper methodology. They utilized materials from their collections without going to the original materials in the CITA repository in order to ensure their identity, precisely in a type of work looking to establish the identity of a plant material. Many nursery plants have been probably sold under the name of ‘Guara’, due to its success, but could be ‘Tuono’ or other similar cultivars. Only the CITA plants could ensure the trueness to type of the materials. Only working with the CITA material would give credibility to the results of such type of identification. As this has not been the case, we may suspect that the interest of this work has been another.

The authors could question better their work instead of that of Fernández i Martí et al. (2009), carried out with the CITA materials, where small differences between ‘Guara’ and ‘Tuono’ were detected in their molecular profile. Small differences in morphology and behaviour were also noticed in our collection, as well as by nurserymen, growers and processors. Additionally, the authors had to know that identity in molecular markers does not
mean identity of genotypes, but only great similarity, and that the establishment of identity between two genotypes requires much more than a simple molecular profile. Probably they did not include the right markers, or their vision was previously defined and only limited to molecular markers instead of looking to the whole tree.

Finally I ask myself if the efforts of 11 researchers, with additional external support, were required for this article, considering its deficiencies, its very low scientific interest, and its questionable objective. Would it have been published in “Scientia Horticulturae” if one of the authors was not an editor of the journal? The scarce research funds could be better directed to more profitable objectives.

Was their only objective to discredit my work, honestly focused in offering a better plant material to the almond sector and whose success in being accepted by the growers has not had any similar success in the Spanish almond sector?

REFERENCES


Antonio J. Felipe (retired almond researcher at CITA Aragón, Spain)

THE ALMOND IN ARGENTINA: EVOLUTION OF CROPS AND VARIETIES IN PATAGONIA

DEVELOPMENT OF THE ARGENTINIAN ALMOND SECTOR

A large part of Argentina’s population comes from the waves of immigration that took place from the XIX century to the beginning of the XX century, mainly from Spain and Italy. The custom of eating nuts, especially almonds, was introduced by the Spanish and Italian immigrants and others. Even though they are consumed all year round, the peak season for demand is from October to December, when industry requires almonds for Christmas bakery products.

As for soils and climatology, Argentina has large areas with very good almond-growing conditions: appropriate soils, high summer temperatures, low relative humidity, sufficient water for irrigation, lack of pests and limiting diseases, thus enhancing the possibilities of growing this crop over large areas. Most almonds are grown today in the provinces of Mendoza, San Juan and La Rioja, and to a lesser extent in Catamarca, San Luis, Salta, Buenos Aires, Río Negro and Neuquén (see Fig. 1). The estimations of the planted surface area up to 2016 are shown in Table 1, most of which are young orchards (almost 50%) which have not yet reached full bearing.

Table 1. Estimated almond-growing surface area in Argentina

<table>
<thead>
<tr>
<th>PROVINCE</th>
<th>surface area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mendoza</td>
<td>2,950</td>
</tr>
<tr>
<td>San Juan</td>
<td>680</td>
</tr>
<tr>
<td>La Rioja</td>
<td>510</td>
</tr>
<tr>
<td>Río Negro-Neuquén</td>
<td>220</td>
</tr>
<tr>
<td>Salta</td>
<td>200</td>
</tr>
<tr>
<td>Other provinces</td>
<td>270</td>
</tr>
<tr>
<td>Total country</td>
<td>4,830</td>
</tr>
</tbody>
</table>

Source: own data based on provincial censuses and information from the nursery sector.

The Argentinian production sector is characterized by small or medium-sized individual producers or small farms with surface areas under 10 ha (approximately 80%). The remainder is composed of large businesses with estates growing over 100 ha of crops.

Orchard technology has evolved in recent decades through different forms of pressurized irrigation, higher planting densities and new plant material. Together with the irrigation system and intensification of modern water delivery systems, tree spacing has become more intensive, with interrow distances decreasing from 7-8 metres to 6-5 metres, and distances between trees from 6-7 metres to 5-4 metres. The densities have thus evolved from 230-250 to 400-500 plants/ha in almost 80% of almond orchards today.

THE EVOLUTION OF ALMOND VARIETIES

The almond was introduced in Argentina by the first Spanish settlers in the XVI and XVII centuries, mainly the Franciscan and Jesuit missionaries arriving from the North and West of the country. The first orchards were planted in the current provinces of Salta, Catamarca, La Rioja, Mendoza and San Juan in small family orchards with almond seedlings that provided wide variability, but because of their early flowering date the orchards suffered losses in harvest from late frosts. From the XIX century until the beginning of the XX century, the varieties introduced by the immigrants were used as grafting material, thus initiating the first commercial plantations. In the first years of development of the important market crops in Argentina, low-quality and self-incompatible varieties were predominant. Lack of knowledge of how to pollinate the species correctly led to errors in the combination of varieties and incompatible crops were included or pure blocks of a single self-incompatible variety were planted, leading to frequent failures.

The seedlings and local selections prevailed in the first years and production was successful, particularly Martinelli C, Martinelli L, Desmayo Catamarca, Cáceres Ciara Chica and Cáceres Roja Grande. In the 1950s Californian varieties were introduced for the first time, namely Non Pareil, Nec Plus Ultra, IXL and Texas, followed by varieties obtained on a national scale by the INTA, such as Emilio and Javier. This led to a substantial improvement in the quality and quantity of production, whereby they were able to supply the national market. However, this supply was irregular as in many years, losses caused by climate phenomena such as spring frosts reached almost 100%.
At the end of the 1980s and in the 1990s varieties were introduced from Europe, mainly from Italy, France and Spain. They were introduced in the provinces of Mendoza and Río Negro and the Experimental Station of the INTA in Junin (Mendoza) and the Experimental Station of the IDEVI in Viedma (Río Negro) which lead to a gradual reconversion of the varieties on a national level.

Regarding the current varietal panorama, according to the censuses, Guara is the most widely grown variety nationwide. The distribution of the surface area per variety planted, does not necessarily mean that production is proportional as almost half of the surface area of this variety is still 7 years old or younger and therefore production is low but it is increasing.

Studies on almond varieties in Argentina have been conducted mainly at:

– the Experimental Station Junin in Mendoza. Studies have been conducted by Silvia Carra, Emilio Touza and Oscar Wouters since the 1950s on varieties and obtention of new cultivars.

– the Experimental Station of Catamarca. Since 1957, studies have been conducted by Antonio Prataviera on genetic improvement and obtention of cultivars of local interest.

– the Experimental Station of the IDEVI (in Viedma, Province of Río Negro). In the 1970s and 1980s, studies were conducted by Juan Rolka and Luis Iannamico on varieties introduced from various origins: Spain, Italy, France, Russia and the United States.

– the Experimental Station Alto Valle (Province of Río Negro). Since the 1990s Luis Iannamico has worked on late and extra-late flowering varieties of Spanish and French origin, studying their productive performance in very cold climates.

Also noteworthy is the work conducted at INTA on selection and genetic crosses in order to expand better-adapted cultivars, especially in the main productive areas of the country, such as the regions of the West – Mendoza, San Juan, Catamarca and La Rioja-. The varieties obtained are summarized as follows:

**Emilito**: is the result of the Peerless x Nonpareil cross. It is a self-incompatible variety, widely grown in Argentina and always accompanied by Nonpareil. The almond has a soft shell (50% kernel percentage). It is very attractive, cream in colour and apt for sale in shell. The kernel has a pleasant flavour and is similar in appearance to Nonpareil but larger. It is a very productive variety and the tree is easy to train and prune. Flowering is mid-early and it is pollinated with Nonpareil, Peerless, Nec Plus Ultra, Martinelli L, Martinelli C, Thompson, Ruby, Merced and Javier INTA.

**Javier**: created in 1985, it comes from a Texas Prolific x Nonpareil cross and expanded in the 1990s, reaching wide acceptance in the productive sector due to its tolerance to frost. It is a highly productive cultivar and the almond has a very soft shell (63% kernel percentage). It integrates the “Nonpareil group”. It interpollinates well with Cáceres Roja Grande, Emilito and Peerless.

**Cáceres Clara Chica**: of unknown origin, it is widely grown in Mendoza. The almond has a hard shell (27% kernel percentage) and an early flowering season. It requires pollination with other varieties. It is sold in shell.

**Cáceres Roja Grande**: of unknown origin, it is widespread in the Province of Mendoza. The almond has a very hard shell (22% kernel percentage) and an early flowering season. Like Cáceres Clara Chica, this variety used to be grown in areas of frequent rainfall during the harvest season, when the humidity spoilt the kernels of the soft-shell variety.

**Martinelli C**: of unknown origin, it is widely grown in the provinces of western Argentina. The flowering season is short and mid-early. Almonds are soft-shelled (50% kernel percentage).

**Martinelli L**: of unknown origin, the letter “L” identifies this variety, which is used as a main variety, due to its longer flowering season and the “C” identifies the pollinator, with a shorter flowering season. It is widely grown in the province of Mendoza. The almond is soft-shelled (55% kernel percentage). As with Martinelli C, it is no longer planted as other varieties have greatly exceeded it in productivity and quality.

**THE ALMOND IN PATAGONIA**

Patagonia is in the southern tip of Argentina below latitude 38 ° S (see Figure 1). The Patagonian region is characterized by a cold, dry climate, generally windy and continental. Depending on the different zones of the region, the continental feature provides special temperature conditions in many cases, making it possible to grow almonds.

In this southern region of the world almond trees have been present since the arrival of the first Spanish settlers to Río Negro under the command of Francisco de Viedma (1779). The almond trees were always planted in family orchards or small plantations subject to harsh spring frosts which damaged production. However, two centuries later, in the 1970s, an important period of research and experimentation in nuts began in the Experimental Station of IDEVI in Viedma under the direction of Juan Rolka, followed by Luis Iannamico. In this research work, together with the hazelnut and the walnut, the almond is one of the 3 species appreciated for its great economic potential. For this reason, varieties have been introduced from other zones of Argentina but fundamentally from abroad, where the main sources of germplasm are to be found:

– from Italy through work conducted with Dr Francesco Monastra of the Istituto Sperimentale per la Frutticoltura-ISF of Rome.
– from France, through collaboration and advice from Dr Charles Graselly, from the INRA of Bordeaux

– from Spain, through collaborations and capacity-building provided by Dr Antonio Felipe from the CITA Aragón

As a result of this work, approximately 60 varieties have been incorporated as study material, and following the corresponding pomological and phenological studies they have been introduced in orchards in the region and taken to other parts of the country. Of all the varieties studied, Tuono, Cristomorto, Aï, Ferragnes and Ferraduel are among the most outstanding for their productivity and almond quality.

From the 1990s onwards, the varieties were studied at the Experimental Station of INTA del Alto Valle, led by Luis Iannamico. In this case only late-flowering and very late flowering varieties were studied, and the collections went on to incorporate the most modern varieties obtained at the CITA of Aragón and IRTA of Catalonia, such as Moncayo, Guara, Felisia, Mardia, Tarraco and Marinada, which enabled the late-flowering period to be extended by several days, thus reducing risk of harvest loss from very low spring temperatures (see Figure 2).

Performance of the late flowering varieties is very satisfactory as far as almond yield and quality are concerned, but in all cases, total harvest safety is only possible if an anti-frost defence system is in place. Sprinkler irrigation is the technology most widely used for this purpose, for cost and safety reasons (see Figures 3, 4 and 5). This technology has saved the crop in the flowering period (August-September) from severe frosts when temperatures dropped to -9°C, thus positioning Patagonia as the southernmost almond-producing region in the world.

Prof. Luis Iannamico*

*Researcher of INTA Alto Valle and Director of Postgraduate Nut Programme, National University of Río Negro
INTA Alto Valle, Ruta 22 Km 1190, General Roca (Río Negro), Argentina
E-mail: iannamico.luis@inta.gob.ar

Fig. 2. Blooming date of almonds varieties in Río Negro (Argentina)

Fig. 3.

Fig. 4.

Fig. 5.
ORGANIC PRODUCTION OF NUTS IN TURKEY

INTRODUCTION

Due to the rapid population growth, agricultural production worldwide has been intensified with the use of chemical and genetic inputs for maximum efficiency, which over time has resulted adverse impacts on human health and the natural environment. Realizing these facts, organic farming is becoming popular recently, and there have been growing concerns on its importance. Organic farming is currently practiced in 163 countries of the world on 43 million hectares of agricultural land with about 17.3 million hectares in Oceania, 11.4 million hectares in Europe, 6 million hectares in Latin America, 3.4 million hectares in Asia, 3 million hectares in North America and 1.2 million hectares in Africa. The main countries which have been increasing their organic-farming lands are Australia, China, Peru, Italy and Ukraine. Organic farming is practiced on 461,396 ha of land in Turkey (Willer and Kilcher, 2015). The key organically produced products around the world are: coffee (22%), olives (19%), nuts (10%), grape (10%), cacao (7%) and citrus fruits (3%). Nuts have significant importance in global production and trade of fruits as they are produced in a more limited number of countries and are essential for human health. Turkey is one of the leading countries in production of the nuts species with economic importance both in terms of the amount of production and of land under cultivation. Besides, it has a large share in global export of many nuts species. Application of organic farming methods worldwide is considered as an important approach to be adopted in production of nuts as well.

Since the data on the amount of global organic nut production and the number of organic farmers are based on the estimations of control agencies, global organic production of nuts is evaluated based on the amounts of organic-farming lands. 323,210 ha of lands are utilized worldwide for organic production of nuts (Anonymous, 2013). Almond (112,541 ha) is the main nuts species produced organically worldwide followed by walnut (53,437 ha), cashew (45,997 ha), chestnut (30,592 ha), hazelnut (23,704 ha), Macadamia hazelnut (8887 ha), pecan (275 ha) and pistachio (282 ha) (Anonymous, 2013). In Turkey, 17,020 tonnes of organic nuts are produced on 12,046 ha of land. The largest amount of these lands, 7407 ha, is utilized for organic hazelnut production, followed by 1341 ha used for organic pistachio production, 1250 ha used for organic walnut production, 1176 ha used for organic almond production and 794 ha used for organic chestnut production. Hazelnut is the nuts species with the highest amount of organic production (10193 tonnes) followed by almond (2110 tonnes), chestnut (1954 tonnes), walnut (1940 tonnes) and pistachio (820 tonnes) (Anonymous 2015).

Spain (86,126 ha) and Italy (22,306 ha) are the leading countries in global organic almond production (112,541 ha) followed by Turkey and Bulgaria. China (34,193 ha) and Bulgaria (5889 ha) are the leading countries in global organic walnut production (53,437 ha); Ivory Coast (17,419 ha) and Tanzania (12,939 ha) are the leading countries in global organic cashew production (45,997 ha); China (13,951 ha) and Italy (7563 ha) are the leading countries in global organic chestnut production (30,592 ha); Turkey (13,371 ha) and Italy (7175 ha) are the leading countries in global organic hazelnut production (23,704 ha); Australia (8,705 ha) and Kenya (8,4 ha) are the leading countries in global organic Macadamia hazelnut production (8,887 ha); South Africa (131 ha) and Peru (78 ha) are the leading countries in global organic pecan production (275 ha) and Iran is the leading country in global organic pistachio production (262 ha) (Anonymous, 2013).

Hazelnut is the major nuts species produced organically in Turkey followed by almond, chestnut, walnut and pistachio. Organic farming methods are being adopted in the areas of Turkey with intensive nuts production. In terms of regional breakdown of nuts production, Southeastern Anatolia is the main production area of pistachio, Aegean Region is the main production area of almond, chestnut and walnut and Black Sea Region is the main production area of hazelnut.

STATUS OF ORGANIC PISTACHIO PRODUCTION

In Turkey, 128,000 tonnes of pistachio were produced on 211,223 ha of land as of 2010 and 80,000 tonnes of pistachio were produced on 282,334 ha of land as of 2014 which were mainly based in Southeastern and Eastern Anatolia. The main provinces of organic pistachio production are Gaziantep, Şanlıurfa, Siirt and Adıyaman. Total organic pistachio production in Turkey still lags significantly behind conventional pistachio farming both in terms of the amount of production and of land under cultivation. Nevertheless, there

Figure 1. Pistachio organic production quantity (tonnes) and area (ha) in the main production regions.
is growing interest towards organic farming practices. The share of organic pistachio farming in total pistachio production which was 0.59% in 2010 has increased to 1.02% in 2014. 757 tonnes of organic pistachio were produced on 139.7 ha of land in 2010, and these figures have increased respectively to 818 tonnes and 1339.7 ha in 2014 (Anonymous, 2014).

In terms of regional breakdown of organic pistachio production as of 2010; Southeastern Anatolia which is the leading area of conventional pistachio farming with its convenient ecological conditions was also the main area of organic pistachio farming (733 tonnes in 84.7 ha of land). This region is followed by Marmara (19 tonnes on 25 ha of land) and Aegean (5.27 tonnes on 30 ha of land) regions. As for 2014, Southeastern Anatolia was again the main area of organic pistachio farming. However, the amount of organic pistachio production has significantly decreased in Marmara Region. In terms of provincial breakdown, in 2014 Gaziantep was the leading province in organic pistachio production with 464 tonnes, followed by Şanlıurfa (274 tonnes) and Adıyaman (52 tonnes).

**STATUS OF ORGANIC ALMOND PRODUCTION**

In Turkey, 55,567 tonnes of almond were produced on 17,440 ha of land in 2010 and 74,524 tonnes on 27,518 ha of land in 2014, which were mainly based in Aegean and Mediterranean regions. The share of organic almond farming in total almond production which was 0.17% in 2010 and increased to 2.81% in 2014.

As for 2014, 2101 tonnes of organic almond were produced on 1167.6 ha of land in Turkey where most of the production was based in Aegean region (660 tonnes). Manisa (502 tonnes), İzmir (85 tonnes) and Muğla (39 tonnes) were the leading Aegean provinces in almond production. Aegean Region was followed by Mediterranean (631 tonnes) and Southeastern Anatolia (565 tonnes) regions. In terms of provincial breakdown of organic almond production, Adıyaman (560 tonnes) was the leading province followed by Manisa (502 tonnes) and Antalya (476 tonnes). In Adıyaman, the share of organic almond farming in total almond production which was 2.66% in 2010 and has increased to 45.2% in 2014. In the Aegean Region which is the center of conventional almond production, Kütahya and Uşak are the main provinces of conventional almond farming but organic farming is currently not being practised.

**STATUS OF ORGANIC WALNUT PRODUCTION**

In Turkey, 178,142 tonnes of walnut were produced on 40,343 ha of land in 2010 and 191,022 tonnes of walnut were produced on 72,568 ha of land in 2014 which were mainly based in Aegean, Marmara and Mediterranean regions. 1926 tonnes of organic walnut were produced on 1248 ha of land in 2014 which were mainly based in Aegean Region, in the leading provinces of İzmir, Manisa, Aydın and Denizli. The share of organic walnut farming in total walnut production, which was 0.59% in 2010 has increased to 1.00% in 2014. In terms of regional breakdown, Aegean Region which is one of the centers of conventional walnut farming also ranks first in organic walnut farming (653 tonnes on 318 ha of land). Aegean Region is followed by Eastern Anatolia and Mediterranean regions. In terms of provincial breakdown of organic walnut produc-
tion, İzmir (415 tonnes) is the leading province followed by Van (265 tonnes) and Mersin (245 tonnes). In İzmir, the share of organic walnut farming in total walnut production which was 1.51% in 2010 has increased to 6.97% in 2014. Additionally, organic walnut farming is becoming popular recently in Bursa province of Marmara Region, Malatya Province of Eastern Anatolia Region and Mersin Province of Mediterranean Region.

**STATUS OF ORGANIC HAZELNUT PRODUCTION**

In Turkey, 599,884 tonnes of hazelnut were produced on 667,765 ha of land in 2010, and 461,702 tonnes of hazelnut were produced on 700,984 ha of land in 2014 which were totally based in Black Sea Region. Black Sea is also the leading region in organic hazelnut production (9777 tonnes on 7278 ha of land). The share of organic hazelnut farming in total hazelnut production which was 1.32% in 2010 has increased to 2.20% in 2014. 7939 tonnes of organic hazelnut were produced on 55 28 ha of land in 2010; as for 2014, these figures have increased respectively to 10 190 tonnes and 7404 ha (Anonymous 2014). Based on the data of 2014, Zonguldak was the leading province in organic hazelnut production with 2 656 tonnes of production on 1772 ha of land, followed by Ordu (2110 tonnes), Samsun (1961 tonnes), Artvin (1 112 tonnes), Düzce (869 tonnes) and Trabzon (495 tonnes). As of 2014, remarkable increases were recorded in organic hazelnut productions of Rize and Sakarya while an opposite trend was recorded in organic hazelnut production of Artvin. In Rize, the share of organic hazelnut farming in total hazelnut production which was 0.51% in 2010 has increased to 40.73% in 2014. Furthermore, it is important to note that respectively 15, 2 and 1 da organic hazelnut farming lands were recorded in İzmir Province of Aegean Region and Konya and Eskişehir provinces of Central Anatolia Region, which are not normally engaged in hazelnut farming (Anonymous 2014).

**STATUS OF ORGANIC CHESTNUT PRODUCTION**

In 2010, 59,171 tonnes of chestnut were produced on 11,853 ha of land, while in 2014 63,762 tonnes of chestnut were produced on 11,116 ha which were mostly based in Aegean, Black Sea and Marmara regions. Aegean (1948 tonnes on 784 ha of land) and Marmara (4 tonnes on 12.1 ha of land) are the two leading regions in organic chestnut production. The shares of organic chestnut farming in total chestnut production in Aegean and Marmara regions are respectively 5.29% and 0.07%. In Black Sea Region which is one of the centers of conventional chestnut farming, only 1 ha of unutilized organic chestnut farming land is recorded in Samsun Province. In Aegean Region, Aydın is the leading province in organic chestnut farming with 1896 tonnes of production and a share of 9.03%, followed by Izmir (Anonymous, 2014). In Marmara Region, small amounts of organic chestnut are produced in Bursa Province (2 tonnes), followed by
İstanbul and Yalova with smaller quantities. Organic chestnut farming lands have been decreasing in Yalova since 2010. Coupled with the transition to organic chestnut production, Aydın, Bilecik, İstanbul, Bolu, Düzce, Kastamonu, Samsun and Zonguldak provinces started organic chestnut farming in 2003. Chestnut ranks third in organic farming (1954 tonnes) and smaller amounts of land are utilized (794 ha) in comparison to those used for organic production of other nuts species. Aydın province continues to achieve the steadiest growth in organic chestnut farming with an increasing trend in numbers of organic farmers, amounts of organic farming land and production since 2003 (Anonymous, 2014).

**CONCLUSION AND RECOMMENDATIONS**

Turkey has a high potential of organic farming due to its suitable climate and soil characteristics. Besides, in conventional farming areas, the use of chemical inputs which are unfavourable for organic farming is very limited and almost non-existent. It is evident that the transition to organic farming is faster in these areas. Raising farmer and consumer awareness by informative advertisements, TV programs, campaigns, briefing meetings and exhibitions, provision of consultancy on organic farming, investments of marketing companies, publicity and promotion are expected to promote organic farming potential. It would be appropriate to consider production and marketing of organic products together. Additionally, it would be useful to compensate farmers’ lack of knowledge and understanding and to make the necessary legal arrangements.

**REFERENCES**


Başak Özdemir¹, Saadet Sevil Yücel², Yeşim Okay¹
¹ Ankara University, Faculty of Agriculture, Department of Horticulture, Dışkapı, Ankara, Turkey
² Bülent Ecevit Üniversitesi, Gökçebe İmam colleagues from the Organic Vocational School, Gökçebe, Zonguldak, Turkey
E-mail:basakcnr87@hotmail.com
LATE SPRING FROSTS AND ITS IMPACT ON TURKISH HAZELNUT PRODUCTION AND TRADE

INTRODUCTION
Turkey is the largest hazelnut producer in the world. Black Sea coastline is a natural habitat of hazelnut where it has been grown for thousands of years. The coastline lies between Artvin (Georgian border) in the east to the limits of Istanbul city in the west (Figure 1). Historically, the main hazelnut production area has been the eastern coasts. Higher support prices and purchase guarantee given by the governments led to large increases in production area since 1963. Growth rate was larger in the western coastline than in the eastern coastline. For example, it was 29.3% in the central and western coastline compared to the 9.2% in eastern coastline between 1973 and 1982 (Okay et al., 1986). Within last 15 years the crop area has increased by 27.8%. The main driving force was the higher prices especially during the low production years. Currently, the area has reached 701,141.3 ha of which 425,597 ha (60.7%) is in the Eastern and 272,245 ha (39.3%) is in the Central and Western Black Sea coasts (Table 1). Recently, the government issued a regulation to limit expansion of land and today 16 districts are officially allowed to grow hazelnuts. Hazelnut growing regions are classified in two groups:

a) Region I (Eastern part of the Black Sea Region) includes Ordu, Giresun, Rize, Trabzon and Artvin provinces (Figure 1). In 2014, some counties of Gümüşhane and Tokat provinces were also integrated to the Region I effective by 01.01.2015 by the regulation. The region is characterized by narrow coastal line and immediately rising hills and mountains. The most of the hazelnut fields are on hills with steep slopes. Production area is classified by elevation: (1) the coastal zone (0-250 m) where the land extends about 10 km towards inland through the mountains is considered to have ideal growing conditions for hazelnuts; (2) the middle zone (250-500 m) is also good for cultivation where the land extends between 10 and 20 km towards inland; and (3) the high zone (500-750 m) that extends between 20 and 30 km towards inland and has a secondary importance for growing (Karadeniz et al., 2009). Some plantations were also established over 750 m up to 1000 m elevation. Region I is known as the old production area which has the optimal climate. Mainly, high quality cultivar Tombul and others such as Palaz, Foşa and Çakıldak are produced. The average orchard size is 1.4 ha. However, soil is shallow (35% of the land is 0-20 cm, and 50% of the land is 20-50 cm in depth). The plantations are old and cultural practices are insufficient. Thus, productivity is low between 800-1200 kg/ha and year to year variation is high.

b) Region II (Central and Western part of the Black Sea Region) includes Samsun, Sinop, Kastamonu, Bartın, Zonguldak, Bolu, Düzce, Sakarya and Kocaeli provinces (Figure 1). This region had a low significance in the past. However, plantations increased rapidly due to high support prices and purchase guarantees since 1963. Growth rate was much higher than the Region I. Hazelnuts were planted in deep and fertile soils of plains such as Çarşamba, Terme, Bafra, Sakarya and Düzce. Also, relatively flat or gently sloping lands facilitate mechanization. The mild climate influence of the sea may diffuse inland areas since there are no high mountains parallel to the sea that plantations extended about 60 km towards inland. The average orchard size is 1.9 ha. Growers harvest 30-50% or even more yields because of good care of young, regular orchards planted on deep and fertile soils.

Figure 1. Hazelnut production regions in Turkey: Eastern Black Sea (Region I) and Western Black Sea (region II)
EFFECT OF LATE SPRING FROSTS ON PRODUCTION

Hazelnut plants are unusual because pollination season is in winter. It is successfully grown nearby large water bodies such as Black Sea, Mediterranean Sea and Pacific Ocean. Production is highly dependent on environmental and particularly climatic conditions. In Turkey, although drought and high temperatures may lead to cluster drops in summer months, crop losses at national level is mostly caused by late spring frosts damaging current season’s shoots, leaves, unfertilized female clusters and even one or two year old branches. Although Region I produces the most of the high quality crop it is highly prone to late spring frosts (Figure 2). Especially higher elevations at around 500 m and over are affected frequently. Radiation frosts as well as cold weather airflows from Caucasus over Russia are to blame. Also, geography of the region is a part of this problem. Because the elevation increases rapidly by the side of narrow coastal land and the mountains are aligned parallel to the coastline. Thus, mild climate influence of Black Sea is reduced by mountains and cannot easily penetrate inlands.

Recent frost events happened in spring months of March, April and May in 1993, 1997, 2000, 2003, 2004 and 2014. Particularly, last two ones caused extensive damage. In Giresun province, for example, the temperatures dropped to -2°C in March, and -0.2°C and -0.8°C in April in 2004 (Ustaoğlu, 2012) which gave rise to serious crop losses by 66.2% in Artvin, 67.2% in Tokat, 68.2% in Ordu, 71.4% in Samsun, 74.2% in Trabzon, 83.4% in Rize and 89.2% in Giresun provinces in Eastern Black Sea region compared to the normal production year of 2002. As result country’s expected production reduced from 600,000 tons to 350,000 tons (Table 1) and the prices went high. On the other hand, frost events did not occur in the Western Black Sea region that the growers harvested almost record high crop and enjoyed the record high prices.

A similar frost event occurred in 2014. In this year, late winter months were warmer than usual that vegetation started early all around the country. At the nights of 29 and 30 March, heavy snow followed by low temperature of -5°C damaged the young leaves, shoots and pollinized female flower clusters and wiped out the crop at elevation of 300 m and over in the Eastern Black Sea region. The total crop losses were 26.5% in Samsun, 31.3% in Rize, 41.6% in Ordu, 47.1% in Trabzon, 75.1% in Giresun and 74.9% in Tokat provinces. However, orchards at coastal zone (below 300 m) were not affected by the frost. Hazelnuts orchards in Western Black Sea region were also damaged by the frost but at a lower degree: crop losses were of 28.1% in Sakarya, 30.4% in Kocaeli and 30.7% in Düzce provinces. As a result, total production of the country dropped from over 650,000 ton (expectation) to

Table 1. Hazelnut production area (ha) and quantity (tons) in provinces in normal (N, 2002 and 2012) and frost affected years (F, 2004 and 2014) in Turkey.

<table>
<thead>
<tr>
<th>Region</th>
<th>Province</th>
<th>Land (ha)</th>
<th>2002 (N)</th>
<th>2004 (F)</th>
<th>2012 (N)</th>
<th>2014 (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Black Sea region</td>
<td>Ordu</td>
<td>227,183</td>
<td>170,011</td>
<td>54,130</td>
<td>145,353</td>
<td>84,874</td>
</tr>
<tr>
<td></td>
<td>Giresun</td>
<td>117,137</td>
<td>105,812</td>
<td>11,480</td>
<td>101,532</td>
<td>25,327</td>
</tr>
<tr>
<td></td>
<td>Samsun</td>
<td>89,594</td>
<td>55,087</td>
<td>15,760</td>
<td>88,392</td>
<td>65,011</td>
</tr>
<tr>
<td></td>
<td>Trabzon</td>
<td>65,432</td>
<td>56,523</td>
<td>14,566</td>
<td>58,767</td>
<td>31,065</td>
</tr>
<tr>
<td></td>
<td>Rize</td>
<td>3,607</td>
<td>1,844</td>
<td>302</td>
<td>1,633</td>
<td>1,122</td>
</tr>
<tr>
<td></td>
<td>Artvin</td>
<td>8,665</td>
<td>4,866</td>
<td>1,644</td>
<td>9,414</td>
<td>9,346</td>
</tr>
<tr>
<td></td>
<td>Gümüşhane</td>
<td>822</td>
<td>204</td>
<td>210</td>
<td>903</td>
<td>878</td>
</tr>
<tr>
<td></td>
<td>Tokat</td>
<td>2,752</td>
<td>1,805</td>
<td>592</td>
<td>2,013</td>
<td>506</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>515,191</td>
<td>396,152</td>
<td>98,684</td>
<td>408,007</td>
<td>218,129</td>
</tr>
<tr>
<td>Western Black Sea region</td>
<td>Sinop</td>
<td>1,676</td>
<td>814</td>
<td>1,240</td>
<td>1,024</td>
<td>1,078</td>
</tr>
<tr>
<td></td>
<td>Kastamonu</td>
<td>7,471</td>
<td>3,209</td>
<td>2,960</td>
<td>4,993</td>
<td>4,231</td>
</tr>
<tr>
<td></td>
<td>Bartin</td>
<td>6,000</td>
<td>1,729</td>
<td>1,870</td>
<td>7,016</td>
<td>6,688</td>
</tr>
<tr>
<td></td>
<td>Zonguldak</td>
<td>23,591</td>
<td>15,415</td>
<td>22,293</td>
<td>25,890</td>
<td>30,148</td>
</tr>
<tr>
<td></td>
<td>Bolu</td>
<td>1,089</td>
<td>122</td>
<td>78</td>
<td>299</td>
<td>364</td>
</tr>
<tr>
<td></td>
<td>Düzce</td>
<td>62,685</td>
<td>61,515</td>
<td>83,531</td>
<td>81,278</td>
<td>56,306</td>
</tr>
<tr>
<td></td>
<td>Sakarya</td>
<td>72,173</td>
<td>111,171</td>
<td>126,485</td>
<td>118,057</td>
<td>84,865</td>
</tr>
<tr>
<td></td>
<td>Kocaeli</td>
<td>7,966</td>
<td>7,240</td>
<td>10,240</td>
<td>10,524</td>
<td>7,323</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>182,652</td>
<td>201,215</td>
<td>248,697</td>
<td>249,081</td>
<td>191,003</td>
</tr>
<tr>
<td>Total</td>
<td>Other</td>
<td>3,399</td>
<td>2,633</td>
<td>2,619</td>
<td>2,912</td>
<td>2,868</td>
</tr>
<tr>
<td>Total</td>
<td>Grand Total</td>
<td>701,141</td>
<td>600,000</td>
<td>350,000</td>
<td>660,000</td>
<td>412,000</td>
</tr>
</tbody>
</table>

Source: Turkish Statistical Institute.
412,000 tons. In the same frost event, temperature dropped between -5 and -8°C in other parts of the country such as Central Anatolia, South East Anatolia and transitional zones between regions where almond, apricot, apple, kiwi, grape, peach, plum, pistachio, sweet cherry and walnut crops were damaged some extent.

IMPACT OF LATE SPRING FROSTS ON PRICES
In Turkey, hazelnuts are usually stored for 3 years if it not sold in the year of production. Grower prices take shape mainly according to current year’s climate conditions, yield forecast and previous year’s stocks. Record high crops or late spring frosts affect grower’s and export prices substantially. In general, prices rise immediately after the frosts. In 2004, the price was around 2.68 TL before the frosts but increased afterwards during the rest of the year until next crop was harvested in August in 2005 (Table 2). A similar trend was observed in 2014. The price was around 6.64 TL before the frosts, but sharply increased to 11.24 TL immediately afterwards. In addition to crop loss, small amount stocks from previous years led to record prices (20.2 TL) in history until May of 2015. With the expectation of a high crop, in 2015 prices started to decrease, and the new season started with 10.75 TL.

IMPACT OF LATE SPRING FROSTS ON EXPORT
Hazelnuts are consumed as snack as well as ingredient (chopped, sliced, mea and paste form) in chocolates, biscuits and confectionary industry making sweets, pastries and ice-cream, and used in meals and salads. Thus there is a strong demand for hazelnut products in the world. Turkey is the leading exporting country. European Union countries are the largest buyers. The share of the EU countries in total export is 73.7% in 2013 and 76.8% in 2014 (Table 3). Exported kernel quantity was 274,657 tons in 2013 gaining 1.767.276.551 $ revenue. In 2014 however, decreased crop due to frost and low amounts of carry over crop from previous year gave rise to record high export prices. Although the amount of kernels exported (252,528 tons) was 8.1% lower, the revenue increased by 30.1% (2.314.253.067 $). Hazelnuts have been providing largest export revenue among exported agricultural crops and it will likely to hold this achievement in the future for Turkey.

Table 2. Changes of highest hazelnut sales prices (TL/kg) in commodity exchange markets by months and years. Data show rapid price increases after frost damage in spring of 2004 and 2014.

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Agu</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>1.74</td>
<td>1.70</td>
<td>1.67</td>
<td>1.64</td>
<td>1.73</td>
<td>1.70</td>
<td>1.77</td>
<td>1.82</td>
<td>1.97</td>
<td>2.78</td>
<td>2.95</td>
<td>2.97</td>
</tr>
<tr>
<td>2004</td>
<td>2.87</td>
<td>2.87</td>
<td>2.68</td>
<td>2.71</td>
<td>3.22</td>
<td>4.60</td>
<td>4.60</td>
<td>4.58</td>
<td>4.99</td>
<td>5.67</td>
<td>5.83</td>
<td>5.52</td>
</tr>
<tr>
<td>2005</td>
<td>5.52</td>
<td>5.67</td>
<td>7.33</td>
<td>6.88</td>
<td>6.75</td>
<td>6.85</td>
<td>6.87</td>
<td>7.0</td>
<td>6.0</td>
<td>6.74</td>
<td>6.53</td>
<td>6.23</td>
</tr>
<tr>
<td>2013</td>
<td>5.02</td>
<td>5.11</td>
<td>5.01</td>
<td>5.11</td>
<td>5.11</td>
<td>6.13</td>
<td>5.58</td>
<td>6.07</td>
<td>6.95</td>
<td>7.20</td>
<td>7.25</td>
<td>6.95</td>
</tr>
<tr>
<td>2015</td>
<td>17.35</td>
<td>17.0</td>
<td>17.3</td>
<td>17.2</td>
<td>20.2</td>
<td>18.4</td>
<td>15.0</td>
<td>11.5</td>
<td>10.75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Giresun, Ordu and Fatsa Commodity Exchanges, *no trade

Table 3. Turkish hazelnut export quantity (tons) and value ($) in normal (N, 2013) and frost (F, 2014) years

<table>
<thead>
<tr>
<th>Countries</th>
<th>2013 (N)</th>
<th>2014 (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity (t)</td>
<td>Value ($)</td>
</tr>
<tr>
<td>EU Countries</td>
<td>202,321</td>
<td>1,301,185,004</td>
</tr>
<tr>
<td>Other European Countries</td>
<td>28,517</td>
<td>182,306,817</td>
</tr>
<tr>
<td>Overseas</td>
<td>25,059</td>
<td>165,792,582</td>
</tr>
<tr>
<td>Other countries</td>
<td>18,760</td>
<td>117,992,147</td>
</tr>
<tr>
<td>Total</td>
<td>274,657</td>
<td>1,767,276,551</td>
</tr>
</tbody>
</table>

Source: Black Sea Hazelnut and Products Exporters Union

REFERENCES


Veli Erdoğan¹, Ahmet Aygün²
¹Ankara University Faculty of Agriculture Department of Horticulture, 06110, Ankara, Turkey
²Ordu University Faculty of Agriculture Department of Horticulture, 52200, Ordu, Turkey
e-mail: verdogan@agri.ankara.edu.tr
NEW PLANTINGS OF GRAFTED HAZELNUT IN SPAIN

INTRODUCTION

Hazelnut (Corylus avellana L.) is found wild in Spain, mainly in northern parts: Pyrenees, Basque Country, Navarra, Asturias and Cantabria, and Central range mountains: Iberian and Maestrazgo. The area devoted to orchards of this species is based in Catalonia, in the province of Tarragona (84% of the Spanish surface). In this area the late eighties the surface was about 35,000 ha of hazelnut cultivation, but in the last 25 years there has been a significant reduction in the crop surface, reaching 11,674 hectares in 2012, mainly due to fluctuating hazelnut market, industry, tourism and road developments in the Tarragona area. Recent years the surface remains at about 12,000 ha. The province of Girona, placed in the northern part of Catalonia, housed 913 ha in 2012, and is one of the areas where the surface of this crop is expanding. In this area climatic (temperature, rainfall) and environmental conditions and soil characteristics are more suitable for hazelnut cropping.

Most traditional orchards are growing in multi-stem bush, are over 50 years old, and have been maintained by renewing shoots, which implies costly labor. Trunk suckering control is a cultural operation requiring four to five herbicide sprays per year and occasional hand removal in winter (15-30% of total production cost). However, in recent years (2010-2016) a crop technological change, using non suckering rootstocks, is developing due to the low profitability of traditional plantations. Modern orchards are becoming single trunk-trained, facilitating mechanized harvesting, reducing the costs of planting and, therefore preserving the environment. The plant material used for this improvement in new orchards is grafted hazelnuts cultivars onto non suckering rootstocks (Fig. 1).

Little research has been done on this planting system. In the 1970s a breeding program at the University of Corvallis in Oregon (USA) looking for non suckering rootstocks began. As results, two open-pollinated seeds of C. colurna were selected: ‘Dundee’ and ‘Newberg’ (Lagerstedt, 1981) (Fig. 3). These rootstocks induced vigor and increased the production of the cultivar grafted. However these selections had no interest to the American hazelnut sector. Seeds of C. colurna as rootstocks are also used in Serbia hazelnut plantations because they do not produce suckers, are resistant to cold and drought and have high adaptability to different soils of the area (Miletic et al., 2009).

Fig. 1. New orchard with grafted hazelnuts

RESEARCH AND EXPERIMENTATION

This technological change for cultivating hazelnuts in Spain, started from the results obtained in IRTA Mas of Bover, in an experimental rootstock trial planted in 2000, which compared ‘Negret’ cultivar grafted on vigorous and non suckering rootstocks with own rooted plants of this cultivar, obtained by layering from mother plants. The trial was established on a calcareous soil, pH 7.8 with drip irrigation, and tree spacing was 6m x 3.5m trained in a free vase system with one trunk and the orchard management was similar to commercial growers. The trial aimed to find a solution for the main variety of Tarragona ‘Negret’, much appreciated by the industry which has a weak vigor, is sensitive to iron chlorosis, is late bearing and emits a large number of suckers. We attempted to reduce all these problems by using vigorous rootstocks adapted to calcareous soils and low emission suckers. The trial was conducted with healthy hazelnut material, ‘Negret N-9’ (IRTA’s selection), ApMV free, which showed to be more productive than the ‘Negret’ cultivar standard (Aramburu and Rovira, 1998). As rootstocks ‘Dundee’ and ‘Newberg’, both obtained at the University of Corvallis in Oregon (USA), together with the Italian variety ‘Tonda Bianca’ and the IRTA’s selection ‘MB-69’ (‘Tonda Bianca’ seed) were used. The results recorded in this trial after nine years of harvest, showed the advantages of grafted trees against own rooted trees (Rovira et al., 2014) (Fig. 2). Among the grafted trees it was observed more vigor, which results in increased production and a significant reduction in suckers number (Table 1). Fruit and kernel weight decreased slightly in trees grafted compared to own rooted trees, due to higher crop of the formers (Table 2), although this minimal decrease in weight, no loss of fruit quality was observed. In grafted trees it was also observed a reduction of iron chlorosis and a delay in the falling leaves, an important aspect, as it increases the content of reserves tree before winter. The root system of C. avellana is shallow; 30-50 cm deep (depending on soil type) is ramified, dense but not very powerful. Contrary, C. colurna root system is strong and pivoting therefore trees have better anchorage and therefore can stand more the effects of strong winds which occur in some areas of cultivation. Plants used in that trial came from the plant mother plants placed at IRTA Mas of Bover, and grafts were performed in winter using the methodology of “hot-callusing pipe” (Lagerstedt, 1981) (Fig. 3).
TECHNOLOGY TRANSFER

The good results obtained in this trial in IRTA Mas de Bover, were presented to the sector through Open Field days and visits to the orchard. There was a very good acceptance by growers who were interested in this new way of growing hazelnuts and especially to introduce the new concept of “hazelnut grafted”. The first commercial orchard was planted in 3 stages (2009-2011) in Alcover (Tarragona, Spain), with an area of about 2 ha. Soon, two growers cooperatives in the area, COSELVA and AVELLANERA, both based in La Selva del Camp (Tarragona, Spain), were interested in this type of material. Nowadays, there are many growers that are planting this new combination “variety / rootstock”. Currently there are about 50 ha planted in the Tarragona area.

Because of this demand in the sector, a large nursery began producing ‘Dundee’ rootstock “in vitro”. The plantlets are sold to the local nurseries (Fig. 4) and the following year are grafted on “chip” (spring or summer) (Fig. 5), depending on the size of the rootstock. Through this type of graft the complexity required when using “hot-callusing pipe” technique with application of localized heat, is avoided. Currently, producing plants “in vitro” has increased significantly (25,000 plants/year) and plants are already grafted during the first year of planting in the nursery, reducing the cost of the tree. So far nurseries have grafted ‘Negret N-9’ variety and their pollinators. However, it is planned to expand the range with other cultivars, mainly the Italian cultivar ‘Tonda di Giffoni’, well adapted to the Spanish climatic conditions, and the local variety ‘Pauetet’, also highly appreciated by the sector. We consider that the good results obtained with hazelnut ‘Negret N-9’ cultivar grafted will be available to other varieties.

Fig. 2. Trial in IRTA-Mas de Bover. On the left side ‘Negret N-9’ grafted onto ‘Dundee’ rootstock; on the right side ‘Negret N-9’ ownrooted

Fig. 3. “Hot callusing pipe”

Fig. 4. Nursery of ‘Dundee’ plants

Fig. 5. “Chip” graft
FUTURE PERSPECTIVES

Following the results presented here, it was found that the use of non suckering hazelnut rootstocks in Tarragona area can solve some of the problems of orchard management, saving time and costs in removing suckers of the trees and, also, facilitating mechanized harvesting crops.

Currently, the demand for grafted hazelnut plants is high, so in the coming years these plantations will increase, transforming the landscapes of Tarragona hazelnut area. Growers in other areas of Spain are also interested in planting these new orchards with hazelnut grafted trees. Growers can ask different varieties to be grafted according their preferences, and always thinking about the climatic conditions of each area, to choose the best adapted cultivar.

Other producing areas are starting to plant grafted hazelnut in their orchards. Some Italian nurseries have ‘Dunde’ produced “in vitro”, in which they graft hazelnut Italian cultivars, and soon in this Mediterranean country and in Chile grafted hazelnut orchards will be established.

The European industry requires more than 1,500 ha of hazelnut plantations per year over the next 5 years, mainly by the decrease of production in Turkey (largest producer with 64% of world production) because areas in the mountainous Black Sea coast, the main producing area, are being abandoned and no investment is occurring, neither the renewal of old orchards. This need of hazelnut that European industry manifests, predicts a bright future for the hazelnut sector. New farming technologies presented in this article, which allow a better economical return on plantations, help, no doubt, to this necessary expansion of cultivation, and growers should not be left out.

ACKNOWLEDGMENTS

The trial of the IRTA-Mas of Bover has been made possible thanks to the Funding from Spanish INIA (RF-01-036, RF2004-00011-00-00, RFP2009-001300-00) projects.

BIBLIOGRAPHY


M. Rovira, J.F. Hermoso, A. Romero, I. Batlle
IRTA Mas de Bover Crta. Reus-El Morell, 3.8 km. 43120, Constanti (Tarragona)
E-mail: merce.rovira@irta.cat

Table 1. Effects of rootstock on vigor (trunk cross section and canopy volume), cumulative yield and suckers in ‘Negret N-9’ hazelnut cultivar, 11 years old. Plant distance 6 x 3.5 m. Period 2003-2011.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Trunk cross section (cm²) 2011</th>
<th>Canopy volume (m³) 2011</th>
<th>Cumulative yield 2003-2011 (kg)</th>
<th>Sucker number 2003-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Dundee’</td>
<td>217.6 a z</td>
<td>13.30 a</td>
<td>37.28 a</td>
<td>4.07 c²</td>
</tr>
<tr>
<td>‘Newberg’</td>
<td>196.1 a</td>
<td>12.60 a</td>
<td>30.88 b</td>
<td>3.12 c</td>
</tr>
<tr>
<td>‘Tonda Bianca’</td>
<td>186.4 ab</td>
<td>9.73 b</td>
<td>22.79 d</td>
<td>9.18 b</td>
</tr>
<tr>
<td>‘MB-69’</td>
<td>237.0 a</td>
<td>10.77 ab</td>
<td>28.13 bc</td>
<td>2.77 c</td>
</tr>
<tr>
<td>Own rooted</td>
<td>112.1 b</td>
<td>8.50 b</td>
<td>23.37 cd</td>
<td>25.44 a</td>
</tr>
</tbody>
</table>

²Mean separation within the columns by Duncan’s multiple range test, P=0.05

Table 2. Effect of rootstock on nut and kernel characteristics in ‘Negret N-9’ hazelnut cultivar. Average from 2003 to 2011.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Nut weight (g)</th>
<th>Kernel weight (g)</th>
<th>Percent kernel (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Dundee’</td>
<td>1.79 b²</td>
<td>0.88 b</td>
<td>46.06 a</td>
</tr>
<tr>
<td>‘Newberg’</td>
<td>1.75 b</td>
<td>0.87 b</td>
<td>49.64 a</td>
</tr>
<tr>
<td>‘Tonda Bianca’</td>
<td>1.80 b</td>
<td>0.87 b</td>
<td>49.07 a</td>
</tr>
<tr>
<td>‘MB-69’</td>
<td>1.78 b</td>
<td>0.87 b</td>
<td>49.03 a</td>
</tr>
<tr>
<td>Own rooted</td>
<td>1.82 a</td>
<td>0.90 a</td>
<td>49.32 a</td>
</tr>
</tbody>
</table>

²Mean separation within the columns by Duncan’s multiple range test, P=0.05

Table 1. Effects of rootstock on vigor (trunk cross section and canopy volume), cumulative yield and suckers in ‘Negret N-9’ hazelnut cultivar, 11 years old. Plant distance 6 x 3.5 m. Period 2003-2011.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Trunk cross section (cm²) 2011</th>
<th>Canopy volume (m³) 2011</th>
<th>Cumulative yield 2003-2011 (kg)</th>
<th>Sucker number 2003-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Dundee’</td>
<td>217.6 a z</td>
<td>13.30 a</td>
<td>37.28 a</td>
<td>4.07 c²</td>
</tr>
<tr>
<td>‘Newberg’</td>
<td>196.1 a</td>
<td>12.60 a</td>
<td>30.88 b</td>
<td>3.12 c</td>
</tr>
<tr>
<td>‘Tonda Bianca’</td>
<td>186.4 ab</td>
<td>9.73 b</td>
<td>22.79 d</td>
<td>9.18 b</td>
</tr>
<tr>
<td>‘MB-69’</td>
<td>237.0 a</td>
<td>10.77 ab</td>
<td>28.13 bc</td>
<td>2.77 c</td>
</tr>
<tr>
<td>Own rooted</td>
<td>112.1 b</td>
<td>8.50 b</td>
<td>23.37 cd</td>
<td>25.44 a</td>
</tr>
</tbody>
</table>

²Mean separation within the columns by Duncan’s multiple range test, P=0.05

Table 2. Effect of rootstock on nut and kernel characteristics in ‘Negret N-9’ hazelnut cultivar. Average from 2003 to 2011.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Nut weight (g)</th>
<th>Kernel weight (g)</th>
<th>Percent kernel (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Dundee’</td>
<td>1.79 b²</td>
<td>0.88 b</td>
<td>46.06 a</td>
</tr>
<tr>
<td>‘Newberg’</td>
<td>1.75 b</td>
<td>0.87 b</td>
<td>49.64 a</td>
</tr>
<tr>
<td>‘Tonda Bianca’</td>
<td>1.80 b</td>
<td>0.87 b</td>
<td>49.07 a</td>
</tr>
<tr>
<td>‘MB-69’</td>
<td>1.78 b</td>
<td>0.87 b</td>
<td>49.03 a</td>
</tr>
<tr>
<td>Own rooted</td>
<td>1.82 a</td>
<td>0.90 a</td>
<td>49.32 a</td>
</tr>
</tbody>
</table>

²Mean separation within the columns by Duncan’s multiple range test, P=0.05
THE NORPATAGONIA NUTS CLUSTER

THE PRODUCTION OF NUTS IN THE NORPATAGONIA
The Argentinian provinces of Neuquén and Rio Negro, both members of the North Patagonian region, have large areas of valleys, on the Limay, Neuquén, Negro and Colorado rivers with abundant water availability, fertile soil and weather conditions which enable the production of a wide range of fruits and vegetables. A clear objective for the region is therefore to identify sustainable and competitive productive alternatives which contribute to the expansion and diversification of the regional production, placing value on those resources.

In this context, the production of nuts—especially walnuts, hazelnuts and almonds—is an attractive alternative. Even without large productive tradition, nut crops have proven agro-ecological feasibility and it are gaining importance in the regional production structure thanks to the benefits that are emerging regarding markets, market conditions and profitability.

Encouraged by the promising prospects of the activity, there are more than 200 primary producers’ establishments in the region, which occupy near 1,800 hectares, plus three nurseries and five conditioners companies. Regional producers showed initiative and commitment to the activity. The production is growing every year, as the already implemented productive areas reach the necessary ageing, while the acreage is still expanding. Currently, most of the production is sold in the domestic market, although there are successful and stable experiences of exports to Italy.

Regional production accounts only 5% of national production that, in turn, does not reach global significance yet. However, Argentina has the potential to be installed as a significant player in the global market for nuts; as long as it decides to encourage the expansion of cultivation taking advantage of the extensive areas that have already proven proficiency. The North Patagonian region has the conditions to become the most dynamic area for these crops expansion. The proven productive feasibility, abundant availability of water and soil allow foresee good growth opportunities in the region valley areas.

THE CREATION OF THE CLUSTER
Given the background of existing interest in the development of the activity by the Province of Rio Negro Government and several initiatives of partnership between regional producers, it was decided to undertake sectoral promotion as part of a new initiative proposed by the National Government: the Cluster Development Initiative (CDI) of the Unit for Rural Change (UCAR), of the National Ministry of Agriculture, Livestock and Fisheries.

The idea behind this initiative was to enhance the processing capacity of public resources for promoting production, generating synergy between multiple actors that, living in the same territorial space, share common interests to favor the establishment of cooperation and contractual relations.

The competitiveness of a relatively isolated venture is considerably smaller than the one embedded in a framework that provides inputs, technical and commercial advice and which has qualified human resources and support services for export or certification quality, among others.

Under this conception, in the North Patagonian Region, the Nuts Cluster was created as an institutional framework of several participating organizations, public and private institutions, with capability and willing to support the development of the activity in the region. The Cluster includes producer organizations involved in each of the producing areas of the region; research, development and knowledge transfer institutions as the National Agricultural Technology Institute (INTA), the National University of Comahue and National University of Río Negro; and related governments’ agencies of the provinces of Neuquen and Rio Negro.
All these organizations and institutions meet the conditions to be located in the same area, to sign a common goal and be willing to make contributions linked to their specific tasks, towards this shared goal of the development of nuts producing activity in the region.

**Objective**

Its aim is to strengthen the region as a supplier of nuts and the competitiveness of the producing chain, promoting the cultivation, production quality, and added value.

**Trajectory**

In 2009 the work began bringing together public and private actors linked to activity in the Lower and Middle Valleys of Rio Negro as part of a participatory planning process. A driver group –formed by producers and companies of the sector– and a technical team –formed by technicians and professionals of public institutions– were conformed and began working together in the drafting of a Plan of Competitive Improvement of the activity (PMC).

In 2010, as a result of this participatory work, the Plan was drafted including agreed objectives to be achieved, areas for improvement to promote and a strategy to promote the development of the activity that took shape in a first set of 16 priority project ideas for the implementation of competitive strategy and the strengthening of the institutional framework.

In 2011 the Association of the Cluster of Nuts was created, thus formalizing the existence of institutional framework that worked together and created a shared work plan. Authorities were elected, with broad representation of the producers sector, and coordination to facilitate the continuous joint work and the implementation of prioritized projects.

From this moment, it was started the final formulation and implementation of prioritized projects by various organizations and members of the Cluster, each of which was intended to bring improvements in each of the strategic identified areas:

- “Market Development”, the Association worked specifically in improving the integration of regional production in the domestic market. In parallel, it launched a Strategic Information System Nuts (SIEFs), including commercial and technical information.
- “Production Technologies”, through the development of a guide for the cultivation of hazelnuts specially adapted to the region. In a trip to Chile with hazels producers also were finalized guidelines for checking production, processing and trading with Chilean production. With INTA participation, they had worked in the development of technological guidelines for regional production, taking into account the main problems to be solved in the production level: frost control, plant health and pest control.
- In the area of “Human resources development”, the Specialization on Nuts was launched –held by the National University of Rio Negro and the National University of Comahue with the support of INTA– in order to form human resources capable to advise in the development of the various links of the nuts chain in the region. Several training courses were organized on specific issues related to the activity.
- In terms of “Conditioning and Industrialization”: Good progress was made in the development of products made with walnuts and hazelnuts (oil and meal); also a regional cooperative of producers was provided with packaging and conditioning infrastructure for walnut production.

Parallel Cluster progressed in strengthening the partnership process and coordination chain and it expanded geographically with the addition of the producers in the area of Upper Rio Negro Valley and Neuquén, which is a traditional fruit-growing area with high potential for the expansion of nut crops. New institutional actors were incorporated to the Cluster, that increased from seven (7) existing organizations and founding institutions to eleven (11). It was very significant the incorporation the province of Neuquén, which shares with Rio Negro agro-ecological conditions and the interest in the development of the activity with different shades.

Contacts with other producing regions were also generated, which took shape in various collaborative initiatives and is currently moving towards the creation of an area of national scope, intended to define policies and strategies for the activity development.

New requirements appeared as the Cluster was consolidated. They defined new projects or deepened in the executed ones. Among these, there is a project to evaluate the possibility of machining certain critical tasks (harvesting, peeling, trimming). Projects such as the training of specialized human resources continued its march with new cohorts of trainees and new training courses are programmed. The objective of improved management techniques also gave rise to new and more ambitious projects. Initiatives to promote added value generated its first results in the formulation of producer groups concerned to implement developments made in cabinet and laboratory, and it renewed the generation of a more ambitious project: to create a service center for added value –the SEPAV Center– for technically accompany those initiatives throughout the region. The commercial promotion included exploring foreign markets and generating new products more clearly.

For its activities, the Cluster Association received State funding resources for approximately $2.6 million and launched projects totaling around $8.6 million, allowing to assert that the initial contribution acted as a strategic factor for leveraging uptake funds from other sources for the competitive improvement in the region activity.

**The workflow**

Among members in the Cluster all strategies are discussed and agreed together,
The Cluster of nuts is currently an initiative in obtaining extra resources needed to implement projects. The producers work actively as “driver group”, expressing problems and expectations, making proposals and participating in generated projects.

A “technical team” formed by technicians and professionals from government institutions, universities and INTA also works. This team is responsible for formulating projects, evaluating feasibility and resources needed to carry them forward.

Coordination is responsible for maintaining the workflow with the participation of all stakeholders. They organize and lead periodic meetings to treat all concerns raised by various organizations and institutions involved. It also proposes organizational patterns, manages the administration of available resources and assists in obtaining extra resources needed to implement projects.

All strategic and current decisions made by the cluster are taken by the Board, composed of representatives of each organization and institutions that conforms it.

The Cluster is on track if we consider the relations of trust and cooperation that create a more friendly business development environment. It is composed of institutions with the skills to make strategic contributions (knowledge, technology development, finance, etc.) as well as private sector organizations interested in promoting the development of the chain in the territory and its competitive improvement.

So far, the Cluster proved its effectiveness in certain areas, like mobilizing human and material resources to contribute to the strengthening of activity. It led to Cluster own expansion because of the desire of producers and institutions from other North Patagonia areas of being included in the Cluster as a way to channel their own institutional objectives. The Cluster managed to overcome changes in the conduct of various institutions and organizations involved, demonstrating that it has ability to overcome political circumstances and institutional changes orientation. It ultimately began to show that is a powerful tool of intervention, with the potential to take hold and bring in a process of sustainable diversification of irrigated areas of Northern Patagonia.

Incorporating technology arises as a purpose as mechanization in some links in the chain is a determinant of competitiveness.

VISIONING

In the immediate future it needs to expand and accelerate the arrival of the actions undertaken through the production sector, deepening their impact. It is necessary to actively promote improvements in management and to incorporate technology as being obtained by research results and experiences that develop in these areas.

Finally, further progress is needed in terms of transforming production. Based on the achieved results, it is appearing the first processing industry, even on a small scale, and it shows the convenience to explore the feasibility of moving to other forms of processing to provide stability and added value to regional production. In this line of work the most ambitious project now drives the Cluster to the creation of the Center for Services for Added Value.

The Cluster also recognizes the need to deepen the knowledge to generate improvements in productivity and competitiveness in the region. Even though it is working on basics of management—which is an achievement of proportions—it is necessary to promote the development of more challenging technical initiatives aiming at sustainable improvement in average yields.

THE CURRENT SITUATION

The Cluster of nuts is currently an initiative in consolidation. We could say that is a young Cluster or “protocluster” as the cohesion and strategic perspective should continue to be pursued actively. Being a “deliberate intervention”, on an activity that had not yet generated the necessary links to ensure its sustainability, it is necessary, while it progress with concrete projects generated by these relationships, to sustain and evaluate maturation process, encouraging the articulation of actors and the development of mutual trust in the framework of cooperative relations.

The Cluster is on track if we consider the relations of trust and cooperation that create a more friendly business development environment. It is composed of institutions with the skills to make strategic contributions (knowledge, technology development, finance, etc.) as well as private sector organizations interested in promoting the development of the chain in the territory and its competitive improvement.

So far, the Cluster proved its effectiveness in certain areas, like mobilizing human and material resources to contribute to the strengthening of activity. It led to Cluster own expansion because of the desire of producers and institutions from other North Patagonia areas of being included in the Cluster as a way to channel their own institutional objectives. The Cluster managed to overcome changes in the conduct of various institutions and organizations involved, demonstrating that it has ability to overcome political circumstances and institutional changes orientation. It ultimately began to show that is a powerful tool of intervention, with the potential to take hold and bring in a process of sustainable diversification of irrigated areas of Northern Patagonia.

Incorporating technology arises as a purpose as mechanization in some links in the chain is a determinant of competitiveness.

VISIONING

In the immediate future it needs to expand and accelerate the arrival of the actions undertaken through the production sector, deepening their impact. It is necessary to actively promote improvements in management and to incorporate technology as being obtained by research results and experiences that develop in these areas.

Finally, further progress is needed in terms of transforming production. Based on the achieved results, it is appearing the first processing industry, even on a small scale, and it shows the convenience to explore the feasibility of moving to other forms of processing to provide stability and added value to regional production. In this line of work the most ambitious project now drives the Cluster to the creation of the Center for Services for Added Value.

The Cluster also recognizes the need to deepen the knowledge to generate improvements in productivity and competitiveness in the region. Even though it is working on basics of management—which is an achievement of proportions—it is necessary to promote the development of more challenging technical initiatives aiming at sustainable improvement in average yields.

Furthermore, it is important to improve the conditions of market access. The region has a significant proportion of the crop in the early stages of production and it has a tendency to expand the area under cultivation, which requires an analysis of the alternatives to define the best options for placement of the expected increased production, placing value in the region’s own distinctive characteristics.

Finally, further progress is needed in terms of transforming production. Based on the achieved results, it is appearing the first processing industry, even on a small scale, and it shows the convenience to explore the feasibility of moving to other forms of processing to provide stability and added value to regional production. In this line of work the most ambitious project now drives the Cluster to the creation of the Center for Services for Added Value.

Lilia Andrada¹, Yanina di Nardo²

¹Unidad para el Cambio Rural (UCAR) del Ministerio de Agricultura, Ganadería y Pesca de Nación, Argentina
²Instituto de Desarrollo del Valle Inferior (IDEVI), Río Negro, Argentina

e-mail: info@clusterfrutossecos.net

Fig. 5. Logos of Cluster’s Members and National Institutions Supporting

Fig. 6. Walnut crop visiting of public and private technicians with specialist from Cluster of Agricultural Machinery – September 2015
The Centro Nacional de Competências dos Frutos Secos (National Centre of Competences of Dried Fruits of Portugal) - CNCFS Association - is a non-profit and private nature organisation created in May 2015 with strong support from the Ministry of Agriculture and the Sea.

The CNCFS has the purpose to promote the development the sector of dried fruit in Portugal, including chestnut, almond, walnut, hazelnut and carob, through the strengthening research, promoting innovation and also with transfer and dissemination of knowledge.

The CNCFS’s main duties, are the definition of development programs and actions through joint activities between his associates, contributing in particular to:

a) Prepare the Portuguese research agenda on the nuts chain, in order to be a reference to the orientation of public policies in this domain and its financial instruments;

b) Promote the competitiveness of dried fruits, ensuring the sustainability of these cultures;

c) Instigate internationalization and exports so Portugal increasingly assume a worldwide outstanding position;

d) Disclose the effect of consumption of dried fruits on human health, thereby promoting their consumption;

e) Promote interaction between the various operators in the sector, strengthening the organization and sharing information and the development of joint strategies;

f) Promote scientific and technological knowledge dissemination, through closely connection with the sector agents;

g) Create conditions for development of experimental activity that is considered necessary to improve the productivity and quality;

h) Preserve the traditional cultivars through study, maintenance and preservation of genetic heritage;

i) Be up as a vehicle for knowledge transfer to the adoption of best practices available.

The CNCFS has more than 30 entities across the country and different sub-chains of dried fruits:

**Production Stage:** Forestry and Environmental Agro Association Terra Fria Transmontana, Forestry Association Vale do Douro Norte, County Forestry and Environmental Association Chaves, Forestry and Environmental Association Vila Pouca de Aguiar, Interprofessional Association for Development of Production and Exploitation of Carob, Portuguese Chestnut Association, Regional Farmers’ Association Terras de Montenegro, Agricultural cooperative Penela da Beira, Agricultural Cooperative of Almond Producers Trás-os-Montes e Alto Douro;


**R&D Entities:** National Institute for Agricultural Research and I.P. Veterinary, Bragança Polytechnic Institute, Beja Polytechnic Institute, Coimbra Polytechnic Institute, Viana do Castelo Polytechnic Institute, Viseu Polytechnic Institute, Castelo Branco Polytechnic Institute, Trás-os-Montes e Alto Douro University, Porto University, Superior Institute of Agronomy;


At this stage of development, the CNCFS direction has as one of its priorities the realization of technical conferences in different regions of the country, searching for new members in order to gain even more coverage and largest number of agents in each dried fruit sub-rows, the experimental projects development and technology transfer, involving CNCFS and his associates, development a page, among others.

In this context, CNCFS in collaboration with AFACC-Associação Florestais e Ambiental do Concelho de Chaves, organised a seminar on the “Opportunities for the nuts chain”, on January 29, 2016, in Chaves, an event that was attended by around 160 technical producer associations, the Agriculture Ministry, farmers and students.

Under discussion were the challenges associated with the production and marketing of hazelnuts, pistachios and walnuts, as well as Trás-os-Montes great potential as a producer of dried fruit, the importance and development of dried fruit prospects in Portugal and financing opportunities Rural Development Programme 2020 to this sector.

In partnership with the Society of Agricultural Sciences of Portugal (SACP), the National Centre of Competences of Dried fruit - CNCFS Association will carry out the organization the First National Symposium Dried Fruits to be held in Ferreira do Alen- tejo on June 30, 2016.

More information: www.cncfs.pt

---

**Fig. 1:** Open ceremony “Opportunities for the nuts chain”, January, 29, 2016 (Chaves, Portugal)
CHILENUT: A SUCCESSFUL EXAMPLE OF AN ORGANIZATION FOR THE INTEGRAL DEVELOPMENT OF AN INDUSTRY

We are the advocates for the interests of those we represent, nut producers and exporters; we take action on all fronts from the productive areas, to the commercial and strategic. Take the time to know some of our history.

Chile is an economy open to the world. It maintains commercial agreements of different types with 58 countries, a task that has taken decades to develop thanks to the joint forces of the public and private sectors. It has become one of the greatest strengths of the country.

The result of this joint effort is evident in the Chilean horticulture industry, since there can be no doubt that Chile is the most important fruit producer in the Southern Hemisphere, supplying more than 100 markets on the five continents. An example of this is the projection that in 2015, Chile will produce more than 2.7 million tons, whose value will be more than US $4.7 billion dollars. Among the more than 70 species and varieties exported annually, there is one that, in the last decade, has become prominent for vertiginous growth and wide acceptance in world markets… we’re referring to walnuts.

Walnuts occupy the fourth place in the 300,000 hectares cultivated in the country covering an area of 27,941 hectares, with an annual growth rate of 3,000 hectares. Actually more than half of the farms are still not in production. By 2020 Chile hopes to export more than 100,000 tons.

In a country that believes in the free market, self-regulation of business people is essential in order to homogenize the different variables that make up the productive processes. This gains still more importance when it comes to food products for the world. That’s why Chile has created guilds among private individuals that act as a bridge or facilitators between the distinct segments that affect the industry. As refers to Chilenut, the Association of Producers and Exporters of Walnuts in Chile (and in general all nuts), soon after its initiation was able to bring together all the consultants and nurseries. Chilenut was established in 2002 with the purpose of defending the interests of those it represents, and also as a way to organize the sector.

In order to meet these objectives Chilenut is linked with public and private organisms to promote a harmonic development of the industry. It has relationships with different universities, not only to work in the area of research and innovation, but also to generate specialized courses and certificates.

Opening of new markets is one of the most successful tasks carried out by Chilenut, together with distinct government entities led by Ministry of Agriculture,
the Chilean counterpart of the USDA known as SAG, and the International Economic Office through its area of export promotion, ProChile. It is an arduous job that involves negotiation and demonstrating the quality of the Chilean product including the phytosanitary conditions in which they are produced, generate protocols and comply with the current laws of the importing countries. This is where the guild contributes by offering advise on technical matters and participating in the international fairs in order to facilitate the insertion of its business people in international commerce.

But that’s not all. Chilenut also is dedicated to updating all of its members. To that end it travels through the country offering cutting edge seminars, whose objective is to provide information about technical and commercial antecedents in the world of dried fruits. The largest crowning, specialized event in the country is Exponut, a meeting which includes technology, innovation, and presentations by both national and international speakers. Each year the event gets better, has more participants and exhibition space: a big achievement in only six years.

These efforts have paid off in wide international recognition for the entity. As proof Chilenut will be the host of the 8th International Walnut Symposium in 2017. This is an academic event created by the International Society for Horticultural Science (ISHS) sponsored every four years in different countries whose objective is to demonstrate the latest technological advances in the cultivation of walnuts.

Chilean producers and exporters have in Chilenut a multidisciplinary entity capable of confronting the distinct challenges put forth in the changing world of food products, including the defense of the interests and representation of its members in the area of development, information and technology transfer, opening new markets and the consolidation of those already established, as well as promoting the consumption of nuts by underlining their generous qualities. All of the above with the objective of seeking to support the industry throughout time with a high level of com
In September 2016 Dr Dunixi Gabiña, deputy director of the Mediterranean Agro-nomic Institute of Zaragoza, took his retirement after working at the Institute for 24 years.

Dr Dunixi Gabiña was born in Bilbao (Spain). He took his degree in Agricultural Engineering at the Polytechnic University of Madrid and was awarded his PhD in Animal Genetics from the same University. He started his career as a researcher in Animal Science in the Centre of Agricultural Development of the Ebro Valley, which is nowadays the Agro-food Research and Technology Centre of Aragon (CITA-Aragon).

In 1981, Dr Gabiña moved to his homeland and was Director General of Agricultural Research at the Basque Country Government; during that time he was closely involved in the development of the breeding programme of the Latxa dairy sheep breed, which nowadays is still running successfully with the joint efforts of the administration, the research centres, the livestock breeders and the cheese industry.

Dr Gabiña joined the Mediterranean Agro-nomic Institute of Zaragoza (IAMZ-CIHEAM) as Deputy Director in 1992. Among other responsibilities at the Institute, Dr Gabiña developed its cooperative research programme, which resulted in the creation of several Mediterranean research networks still active today, and in the participation of the Institute in numerous European research projects since the nineties up to the present. He was one of the promoters for the creation of the FAO-CIHEAM Network on Nuts and acted as its liaison officer at CIHEAM for many years. He enthusiastically participated in the Network activities, including those of the Mediterranean Research Group for Almond and Pistachio (GREMPA), he cooperated with the organization of different symposia, meetings and conferences in the framework of the network, and was also the promoter of the several IAMZ advanced courses for professionals organized during the nineties and the first decade of 2000. Although not a specialist on fruit trees, Dr Gabiña showed special interest and sensitivity for the world of Mediterranean nuts, and contributed with his wide experience and working capacity to the cooperation aims of the FAO-CIHEAM Network on Nuts.

FERRERO HAZELNUT AWARD CONTEST

Award Ceremony at Milan Expo 2015

It took place at Milan Expo 2015 the award ceremony for the “FERRERO HAZELNUT AWARD CONTEST”, an award given to finance and improve both research and innovation in the hazelnuts’ sector.

The price was promoted by the Ferrero Hazelnut Company, which aims at developing on a global scale the hazelnut sector by positioning itself as main actor for innovation, good agricultural practices, and territorial sustainability.

“We are satisfied with this initiative – commented Mauro Fontana, Technical and Scientific Director of Soremartec – as I have seen the participation of numerous PhDs students and researchers from universities, research institutes, and non-profit organizations from around the whole world, who have presented projects related to the improvement, innovation, sustainability, and to new strategies of hazelnuts’ farming”.

The “Instituto de Investigaciones Agropecuarias”, INIA Carillanca (Chile) won the first price, consisting in €150,000, with the project “Improvement hazelnut production incorporating novel technologies for the most important world production areas”.

Second place went to Università degli Studi di Perugia (Italy), with the project “New cultivation system for more profitable and sustainable hazelnut growing’.

Finally, third place went to the Institut de Recerca i Tecnologies Agroalimentaries, Torre Marimon, Caldes de Montbui (Spain), in collaboration with the Agricultural, Forest, and Food Sciences Department (DIFASA) of the University of Turin (Italy) and the Agricultural, Forest, and Food Sciences Department (SAF) of the University of Palermo (Italy), with the project “Developing a modern hazelnut industry by innovative crop technology and plant material”.

Each of the runners-up received a €5,000 price.

Dr Gabiña (1st from the right) at the opening of the 6th International Symposium on Hazelnut, held in Tarragona-Reus (Spain) in 2004.
Two special mentions went to ENEA Casaccia for the project “Morenut: merging innovation and traditions to boost hazelnut sustainable economic development” and to the University of Tuscia, for the project “Metagenomic and non destructive sensor for microbiome mapping and nut quality in hazelnut chain: metasensnut”.

The proposals were received, evaluated, and ranked by an external and independent scientific commission, established by the Università Cattolica del Sacro Cuore of Piacenza, and coordinated by Professor Lorenzo Morelli, President of the Agricultural, Food, and Environmental Sciences Department, based on a scorecard promoting innovation, sustainability, and ease of implementation of the projects presented.

**International experts** of the sector, such as Thomas Molnar, Jean-Luc Reigne, Marco Scortichini e Ximena Rueda participated in the event as well.

These awards prove once again Ferrero’s constant dedication towards quality’s excellence and towards innovation, the continuous search for sustainable agricultural practices, and its respect for the environment, elements that have determined the company’s global success.

---

**A PRIZE OF RECOGNITION FOR ANTONIO J. FELIPE AND RAFEL SOCIAS I COMPANY**

The Alianza Agroalimentaria Aragonesa (Aragonese Agri-Food Alliance) recognized the research efforts of A.J. Felipe and R. Socias i Company in the development of new almond cultivars and their effective transfer to the almond growers. They received the Prize on October 23, 2014 and in that occasion they said the following words of thanks:

Words of Antonio J. Felipe:

Fist I feel obliged to express our gratitude to the Alianza Agroalimentaria Aragonesa and, according to its part in it, to the College of Agricultural Engineers, for conceding this prize, highly gratifying to me since I have been retired for more than 16 years, at an age when one usually only keeps good souvenirs and experiences from the professional times. At this moment I only expect that the persons with whom I shared efforts, illusions and works, those I knew along the years or only met a few times along my professional activity, may remember me with affect or sympathy, at the same level of my feelings towards them.

The less agreeable moments have fallen in oblivion, more and more with time, and it is satisfactory to say that they were the least.

Once I made these allusions to my personal feelings, I would like to leave some token that this prize may have been granted to Rafel and me because we have headed a team working in close collaboration during many years in order to better know and improve the almond plant material.

I want to remember and share this distinction with all those collaborating in our work with their contributions of any kind. But, since they are so many, the attempt to name all of them would be impossible. However, it is of justice to especially recognize the valuable collaboration of all the people from the Unidad de Fruticultura, from the colleague researchers to the field workers, as well as to the doctoral students, the scholars and all those spending some time with us. Our gratitude goes also to all those collaborating with our work even not being CITA personnel.

It is convenient to remember that fruit tree breeding is a very time requiring job. The years of work in planning, developing and coordinating all the different tasks in order to reach the established objectives must be counted in decades. As a consequence, many people take part in this work with contributions of all kind.

In order of not wasting uselessly years of work, a previous and clear knowledge of the problems to be solved must be

---

Dr Antonio Felipe and Dr Rafael Socias i Company received the prize from Mr Joaquín Olona, Counselor of the Department of Rural Development and Sustainability of the Aragon Regional Government.
reached in order to plan carefully the procedure to follow and to arrange all the required resources. plant material, facilities, funds, etc.

Our activities on almond breeding started in 1965, devoting the first stage to compile information on the problems affecting almond growing in the different Spanish growing regions, reaching the following conclusions:

- The usual cultivars were early blooming.
- Late frosts were very frequent.
- Very low presence of bees, absolutely required for cross-pollinating the self-incompatible cultivars then grown.
- The only rootstocks were seedling almonds.
- In order to improve almond production cultivars solving these pitfalls were required, as well as rootstocks more efficient and suitable for irrigation.

At the beginning we looked to establish a large and diverse almond collection. It included mainly cultivars from the Mediterranean countries, but also from California, Northern Africa and the then Soviet Union. I must mention the guidance of Dr. Grassely, from the French INRA in this beginning as well as his collaboration during all time. We assembled more than one hundred cultivars, including also our prospectus, thus allowing the observation of the wide genetic variability of almond.

At the same time Rafel Socias i Company went to complement his formation with a post-graduate scholarship at the University of California at Davis, under the guidance of Dr. Dale E. Kester, the highest world authority on almond and of fond memories for many of us. When he returned to Spain we had the fortune of his integration in the Unidad de Fruticultura to collaborate in the team of almond research. Since then, his fondness, enthusiasm, clinical eye and scientific preparation has been the motive power of the almond cultivar breeding in our group. Soon after his incorporation, I shifted to work mostly on rootstocks.

I shall finish concluding: The result has been that the team working on almond breeding in Zaragoza has obtained a series of cultivars allowing the solution of many of the problems found at the beginning of our work. The cultivars put at the disposal of the Spanish growers were at that moment the mostly advanced in solving these problems. It is satisfying to see that they continue improving not only the almond production in Spain, but also in other countries.

To complement the improvement of the plant material, our team has also worked in breeding new rootstocks, probably the mostly efficient, at least for almond, among those available at present. They have also contributed to the improvement of almond production searched by us.

We must recognize that all the problems have not been yet fully solved. However, some important advances have been obtained and some ways were laid out, being adopted by other research teams.

I finish restating my thanks to the Alianza Agroalimentaria Aragonesa for the Prize and to all you for your attention.

Words of Rafel Socias i Company:
Firstly I would like to thank the Alianza Agroalimentaria Aragonesa for this recognition. It is specially valued as it comes from civil society, meaning that our work has actually reached the final recipients for whom we undertook our work. I have always believed that research must give something back to society as a service for the funding we receive from it. These funds are administered with austerity by the Government, who in turn do not always appreciate the results. Consequently, since it is recognition from Society and not from the Administration, it has special significance for me, and for which I am sincerely grateful.

Secondly, as Antonio has already done, I would like to extend my gratitude to all those that have worked with us over our years of research. It is impossible to name them all. Agricultural research is a work of synthesis, where the efforts of all must be united, as with any agricultural production, where the synthesis of many factors contributes to the success of production: plant material, soil, climate, orchard management... Therefore, I would like to share this recognition with all those that have been involved in this work.

Thirdly I must express my personal gratitude to Antonio Felipe for many reasons. I repeat that all of us working in plant breeding drink from wells we have not dug and are warmed by fires that we did not build. However, when Antonio started his work on almond in 1965, there were very few previous works and he had to start by digging the well and lighting the fire. I have been able to profit from his work, and therefore feel the need to express special acknowledgement of it. Therefore, please allow me to say some words directly to him.

Thank you, Antonio, for your tenacity. You undertook the commitment to work on almond even though some in charge of fruit research did not support your dedication. Time has shown their lack of vision through the success of your work.

Thanks, Antonio, for your confidence. Even though the same person did not want me to work with you on almond research, you made my collaboration possible. I hope that I have been worthy of the confidence you placed in me then.

Thank you for your example. You know that I believe that an agricultural researcher must be humble because he is aware of how much he does not know. He must be open, in order to transmit what he knows. And he must be adaptable, in order to give a lecture in an international symposium or a talk in the smallest village. And you have been an example of all that, together with two other leading researchers whose names I do not want to forget at this moment, Mariano Cambra and Manolo Carrera.

Thanks for your teaching. I had the enormous privilege of having known the three leading almond researchers of the 20th century: you, Dale Kester and Charles Grasselly. I have been able to admire your dedication and collaborate in your work. Very few people have had the opportunity to be proud of such masters.

Thank you for your dedication. My opinion that engineers must not give answers but provide solutions has been fully demonstrated with you. The Spanish almond sec-
tor has found many solutions to its problems thanks to your work. The success of ‘Guara’, with such an Aragonese name, probably does not compare with any other in the history of Spanish agriculture.

Upon your retirement, my efforts for you to receive the Great Cross of Agricultural Merit was to no avail due to the Administration’s lack of generosity, conferring you the Medal alone, even upsetting our autonomic authorities. However, civil society today recognizes your merit.

Thank you finally, Antonio, for allowing me to accompany you for many years in your research. And my most sincere thanks to the Alianza Agroalimentaria Aragonesa for their recognition of my endeavour, which is no more than the continuation of Antonio’s work. At this moment, my only wish is that the well will not run dry and the fire will not burn out.

Thank you very much.

CASTANEA, A JOURNAL ON CHESTNUT

Since 2014, the Department of Agriculture, Forest and Food Sciences (DISAFA) of the University of Turin and the Regional Chestnut Center of Piemonte publish an online Journal, CASTANEA (ISSN: 2284-4813) that offers scientific and technical contributions by researchers, technicians, traders and people interested in chestnut cultivation. Thanks to the contribution of many experts in chestnut cultivation, CASTANEA represents in particular an overview of Italian chestnut statement, with constants insights dedicated to the chestnut producing countries in the world. The underlying concept of the magazine is that chestnut has not only an important history, but also a promising future. For this reason the magazine is dedicated especially to the new generations, adopting a young language, and a modern form of communication. Online journal version can be consulted at www.centrocastanicoltura.unito.it/newsletter.html and an email could be sent to centro.castanicoltura@unito.it requesting to receive the magazine via email.
INTERNATIONAL NUT EVENTS IN ARGENTINA

During last years (2014-2016), international events on Nuts were carried out in Argentina:

Postgraduate Course on Nuts (Viedma and Alto Valle). During years 2014 and 2016 a postgraduate course on nuts were held in Río Negro Province. The courses were organized by two Universities: Universidad de Río Negro and Universidad de Comahue and twenty five students completed the course. International teachers were invited to give the lessons (teachers from Argentina, Chile, Italy, Spain and Iran). The director of the course was Dr. Luis Iannamico, Researcher of INTA and Professor of both Universities.

III International Seminar on Nuts (Neuquén, 15-17th October, 2014. The seminar was organized by INTA Alto Valle, the “Consejo Federal de Inversiones” (CFI) and Centro Pyme Adeneu of the Neuquen Province. As lecturers were researchers from Argentina, Chile, Italy and Spain. During the seminar, almond and hazelnut orchards were visited. There was a participation of 120 people. All talks were available on the web page of the organizing institution (www.CPYMEADENEU.com.AR)

These events demonstrate the increasing interest there is in Argentina for nuts.

AGROPINE MEETING WITHIN MEDPINES, 2014

During the 5th International Conference on Mediterranean Pines (Medpine5), held in Solsona in September 2014, participants involved or interested in research and development on Mediterranean stone pine and its management or cultivation for cone and pine nut production joined a meeting hosted by the FAO-CIHEAM Network on nuts and the European Research Project StarTree on Non Wood Forest Products. The aim of the meeting was to establish and/or reinforce networking and detection of common research interests and expertise, as well as to share information on research lines and ongoing projects of different groups around the world.

Researchers and forest managers from the Iberian Peninsula, the Maghreb, Lebanon, and Chile exposed ongoing projects such as: the StarTree Project (www.star-tree.eu), the Portuguese PINEA-project (www.pinuspinea.com), the recent Spanish-Tunisian collaboration about grafted stone pine for rural development, the initiative of the German GIZ about pine nuts value chain enhancement in Maghreb and Lebanon, or the Chilean project FONDEF DI11/1134 about the use of Mediterranean stone pine in South America as nut crop.

Main research lines presented are genetic selection, silviculture and (especially, grafted) orchard management, growth and yield modelling, and value chain development, that will imply stakeholder support.

Also problems affecting forest management, related to the the pine nut sector and the development of its value chain specific for each country or common, were named. Main problems subsume the lack of forest management, of processing and trade standards and adequate product labelling, as well as cone pillage and black market, and an increasing yield loss possibly due to the ongoing climate change. Special attention gained the acute problem of the Dry Cone Syndrome, a recent phenomenon described for stone pine and other species in Italy, Spain, Portugal, Turkey and other countries, that consists in a massive abortion of unripened conelets, as well as a high percentage of empty seeds in ripened cones. Putative biotic agent is the western conifer seed bug, Leptoglossus occidentalis, an invasive alien pest from North America, where it is known to causes similar damaged in native pines. The Lebanese forest managers present in the meeting confirmed the recent appearance of this kind of damages in their pine stands, reducing considerably the cone and seed yields.

Interest in common topics and need for cooperation and collaborative research were underlined for overcoming small critical mass of local institutions; actual contacts exist already among several of the countries or institutions presented in this ad-hoc meeting, while other relevant actors (especially from Italy and Turkey) were absent in the medPine side-event.

Possible frameworks for collaboration are the FAO/CIHEAM Network on Nuts, as well as existing FAO Silva Mediterranea and a new IUFRO unit in Division 1 Silviculture, or within the existing Units 1.01.10 “Ecology and silviculture of pine”, or in the Division 5 Forest Products, 5.11 NWFP. Unit 5.11.03 - “Edible forest products”.

Figs. 1 and 2. III International Seminar on Nuts, 15-17 October, Neuquén (Argentina)
The XVI GREMPA (Group de Recherches Méditerranéennes pour l’Amandier et le Pistachier) Meeting took place from 12 to 14 May 2015, at the National School of Agriculture of Meknès (Morocco). The meeting was organized by the National School of Agriculture of Meknès (ENAM, Morocco) and the Mediterranean Agro-Nomic Institute of Zaragoza (IAMZ-CIHEAM), under the auspices of the Moroccan Ministry of Agriculture and Fisheries. These meetings are held every three/four years and bring together the Mediterranean and world’s leading experts on almond and pistachio. The aim of this XVI GREMPA meeting was not to be a congress, but rather a colloquium to discuss the issues challenging almonds and pistachios and to promote the active participation of researchers from all Mediterranean countries. Researchers, professionals and students from other regions of the world with Mediterranean climate, where these species are also important, were openly invited. The meeting provided scientists, professionals and students with an opportunity to present their latest findings and discuss their current work in the area of basic and applied aspects of Almond and Pistachio cultivation and production. The meeting was attended by more than 70 researchers and professional from 10 different countries (Algeria, Australia, Belgium, France, Hungary, Morocco, Spain, Tunisia, Turkey, and USA). The scientific programme of the meeting consisted of five thematic sessions with oral presentations and posters. Sessions were moderated by internationally renowned researchers in each of the topics.

The opening lecture was given by Dr. Rafel Socias i Company (CITA, Zaragoza, Spain), on the subject “GREMPA: A useful initiative for cooperation in almond research”, in order to review the origin and the first steps of this useful Group, now that its founders, such as Drs. Grasselly and Felipe, have already retired and many circumstances of its initiation may be forgotten.

The session “Genetic Resources. Cultivars” was moderated by Dr. Federico Di Centa (CEBAS-CISIC, Murcia, Spain) who highlighted the significance of the new self-compatible cultivars on world production, the importance to evaluate pests and diseases, and the utility of molecular markers in breeding programmes.

The session “Genetic Resources. Rootstocks”, moderated by Dr. María José Rubio (CITA, Zaragoza, Spain), presented the traits of the most important rootstocks released by different breeding programmes around the world. She also stressed the importance of selecting new rootstock resistant to abiotic (drought stress) and biotic (nematodes, fungi and bacteria) stresses. Moreover, some works were presented on the impact of osmotic drought stress on growth parameters in pistachio rootstocks and the morphological variation in the pistachio terebinth tree. Results related to the behavior of some new rootstock of almond in the field were also presented.

Fig. 1. Visiting almond orchards in the National School of Agriculture of Meknès (Morocco)
Prof. Mohammed Bolif (ENAM, Meknès, Morocco) moderated the session “Pest and Diseases”. He reviewed pests and diseases affecting almonds, mainly in Morocco, as well as the different strategies to manage and control them. Besides, different works were presented on pest and disease attacking pistachio and almond in different Mediterranean countries.

The session “Orchard management”, moderated by Prof. Ali Lansari (Morocco), stressed the importance to choose the adequate cultural system taking into account the new scenario of climate change and the commercial profit of the culture. The presentation in this session focused on the innovation of the training system in almond by the implementation of high density orchards using new varieties and low to medium vigorous rootstocks, considering the mechanization of pruning and the application of chemicals to improve fruit set. Also, the effect of climate change on the phenology and drought stress on these species was discussed.

Prof. Michelle Withensohn (University of Adelaide, Australia) moderated the session on “Quality, industrialization and marketing”. The presentations in this session analysed the chemical and nutritional characteristics of almond and pistachio kernels as well as its impact on the commercial and industrial quality and end-uses of the kernel and highlighted the influence of the yield on the quality of the kernel. Furthermore, new technology and techniques to determine the traceability and quality of food and its application on nut fruit developed by different European scientist was presented.

The first day included a visit to the orchard installed in the National School of Agriculture, where Prof. Ossama Kodad and his colleagues are evaluating the progenies obtained from the crosses among introduced commercial varieties and local selections. The second day a technical visit, during which the participants visited an almond orchards in the Region of Meknès, where self-compatible almond cultivars recently introduced are grown in order to overcome the problems related to lack of pollination among self-incompatible varieties traditionally cultivated in Morocco. Prof. Ossama Kodad explained the main characteristics of almond cultivation in Morocco, under rainfed and irrigated conditions. The owner of the property offered a delicious appetizer to participants with regional products. In the afternoon of 14 May, the participants visited the ancient city (Medina) of Meknès.

At the end of the GREMPA meeting, chaired by the convener Prof. Ossama Kodad, the participants paid homage to Dr Rafael Socias i Company, retired in 2014 after a successful professional career. His scientific contributions, as well as his practical results, have been fundamental not only for a successful development of almond in Spain, but also in foreign countries. His work in common with Dr. Antonio J. Felipe in the release of new self-compatible cultivars and new almond rootstocks adapted to different edafo-climatic conditions has been essential in the present evolution of almond growing. Prof. Ossama Kodad, who was a PhD student under him, talked about the great scientific and human values of Dr. Socias i Company. Prof. Thomas M. Gradziel from the University of California at Davis and Prof. Ali Lansari from Morocco also stressed the added value of the contributions of Dr. So-

Fig.2. Participants in the XVI GREMPA Meeting on Almond and Pistachio, Meknès (Morocco)
THE 1ST EUFRIN NUT TREE WORKING GROUP MEETING

A report back from the Shell Fruit Species Working Group Meeting held November 2015 in Hungary.

A Shell Fruit Species Working Group was founded in January 2015, by an of the European Fruit Research Institute Network (furthermore EUFRIN) board member. This WG focuses on new innovations in the European Persian walnut, almond, hazelnut, chestnut and pistachio research and production. The WG aims to represent the European researchers dealing with nut fruit species. Breeders, plant pathologists, plant physiologists, food scientists, researchers in nursery production, micro-propagation, pathogens, insects, evaluation of cultivars, rootstocks, orchard systems, post-harvest, market value on the nut fruit species are welcome in this WG.

To register interested participants or researchers should send an e-mail to the chairman of the Group. The WG is interested in new tendencies, results of the members, and thus organises a 2-day meeting every two to three years. This WG is to summarize the European nut tree research and represent the requests and interests of the WG members to European authorities and funding organizations.

The first WG meeting was held at the National Agricultural Research and Innovation Center Fruitculture Research Institute in Budapest (Hungary) on 10 and 11 November 2015. During this meeting 25 delegates representing 11 countries (France, Spain, Italy, Slovenia, Bosnia and Herzegovina, Macedonia, Serbia, Romania, Slovakia, Iran, and Hungary) reported their nut fruit species industry as well as results of their new research.

There is a keen interest in Persian walnut, almond, hazelnut and sweet chestnut production in Europe, and the production remains stable with a slightly increasing tendency. All participants presented data on their research activities, supporting the local shell fruit species production. The researchers focus on breeding work and there are some promising novel bred varieties across Europe under evaluation. In the case of Persian walnut the late leafing, high yield, lateral bearing, large fruit size, good fruit quality and tolerance to Xaj are the most important breeding aims. Almond needs a late flowering time, self-fertility, early ripening time, abundant yield, good fruit quality, easy training, and tolerance to hard climatic conditions. Chestnut is mainly produced in the agro forestry plantations, because the European sweet chestnut species is very susceptible to chestnut blight. Breeding needs to have better tolerance to this disease to save this fruit species. For hazelnut it is important to have late leafing and blooming cultivars with large fruit size and good fruit quality.

Beside the scion breeding rootstock breeding is important for almond and hazelnut. For almond there are many rootstocks available on the market, therefore it is not easy to make the right decision on which one is the best for the chosen variety. Hazelnut needs non-suckering root-
Cross breeding is the most used breeding method for Persian walnut and almond, however clone selection is also used for all shell fruit species. Beside the four mentioned fruit species, breeding of carob, pistachio, and pinion pine are also investigated in Europe.

Other research activities on basic research level related to the different nut fruit species include floral biology research which focuses on the special flowering characteristics of shell fruit species and frost hardiness research focuses on the behaviour of varieties to the low temperature during the dormant period. The participants reported on new innovations in the harvesting technology of nut fruit species. The shell fruit species don’t adapt well to the different climate conditions, however there are some varieties with a wide adaptation in the assortment. In the middle part of Europe varieties derived from France are mostly used by growers, in the southern part of the old continent Californian bred varieties are preferred. Key factors of growing technology are based on pruning, but methods of pruning (hand pruning or mechanical pruning) and frequency of pruning need to be clarified. There are also some trials in the participant countries about intensive growing systems. The high density orchards are common-use practiced in the pome and stone fruit species, and researchers are trying to apply this technology to the nut fruit species. There are some innovations in the harvesting machines functioning such as permanently shaking. Post-harvest technology of nut fruit species is also one of the key factors of cultivation, which should be described.

Nut fruit species are rich in beneficial compounds (minerals, unsaturated fatty acids, proteins and antioxidants), but there are some compounds, which haven’t been identified yet. Unfortunately, these compounds cause that the nut fruit species have a large energy content. To avoid the dramatic increase of body weight small intake of dried fruits can be up to 30 g per capita daily. This intake has positive effects on the rate of harmful and good blood cholesterol content and blood lipids, as the essential oil of nut fruit species has an antibacterial effect as well.

The participants decided that the working group will try to apply for a H2020 grant and a COST grant in 2016. The group accepted that the working group name should be changed to “EUFRIN Nut Tree Working Group”. The first working group meeting has been established and I hope that in the near future (within two to three years) we can have another WG meeting to discuss our results and share our new innovations related to nut tree species.

The European Fruit Research Institute Network is a non-profit voluntary organisation of university departments and research organisations specialized in research, development, innovations, and extension in temperate fruit crops that can be grown in the territory of Europe. The first EUFRIN meeting was in 1992 in Bonn, with nine countries (Germany, France, Switzerland, Italy, Greece, Belgium, Denmark, United Kingdom, the Netherlands) taking part in the event. Today there are more than 20 member countries of EUFRIN. The main aim of the EUFRIN is to enhance and facilitate coordinated research, development, innovation and technology transfer, focused on aiding sustainable production of quality fruits, to establish and improve cooperation between those involved in fruit R+D+I within Europe, to prepare and submit joint bids for funding of R+D+I, and to create a philosophy of fruit production through research and education.

Researchers dealing with the following activities are free to join the following Working Groups: Apple and pear variety testing, Peach and apricot, Plum and prune, Cherry, Soft fruits, Shell fruit species, Rootstocks for fruit trees, Fruit thinning, Fruit quality, Improvement of fruit by biotechnology-fruit breedomics, Spray application technique, Sustainable fruit production to minimize residues, Water relations and irrigation, Strategy and vision. For more details please visit www.eufrin.org website.

I take the opportunity to say sincere thank you to our sponsors (Hungarian grower [anonymous], Hungarian Horticultural Cultural Material Non-profit Ltd. and Juglans Hungaria Ltd.) for providing financial support to this nut tree working group meeting.

Géza Bujdosó chairman EUFRIN Nut Tree Working Group resinfru@yahoo.com

2ND INTERNATIONAL MEETING ON MEDITERRANEAN STONE PINE FOR AGROFORESTRY – AGROPINE2016

Last 18th-20th May, the 2nd International Meeting on Mediterranean Stone Pine for Agroforestry - AgroPine2016 was held at INIAV Oeiras, Portugal. The meeting brought together more than 80 experts, researchers, public and private forest managers and land owners, as well as pine cone processing enterprises from Spain, Portugal, Tunisia, Turkey and Lebanon, with some participants from Italy, France and Australia.

During the meeting, five main topics were discussed: Management for cone production in forests and agroforestry; Growth and yield modelling; Genetic improvement, selection and breeding of stone pine; Pine nut industry and markets; and Biotic risks and their impact on stone pine products, especially the invasive exotic seed bug Leptoglossus occidentalis.

Thanks to the high value of Mediterranean pine nut kernels, stone pine has area expanded threefold to nearly 1 million hectares, mainly in the Mediterranean region, though its cultivation as pine nut crop has started also in New Zealand, Australia and Chile. Half of this increase has been done by private landowners, especially in the last 20 years. In Portugal and western Turkey, with maritime influence tempering Mediterranean climate extremes, the current expansion is already fourfold the original area, reaching 175,000 and 195,000 hectares, respectively. Cultivation of stone pine as agroforestry system or orchard crop, including grafted plantations, allows forest owners get revenues from annual cone crops.

Among meeting conclusions regarding stone pine forest and orchard management, rational reference values were demanded for optimised fertilization schedules in stone pine, either to correct soil status before plantation or to increase cone production during exploitation. Long term experiments are essential for testing different practices, namely irrigation, fertilization and pruning in grafted plantations for higher cone yields at younger ages and lower inter-annual variability (masting).

In growth and yield modelling, advances in comprehension and quantification of bi-

FAO-CIHEAM - Nuci-Newsletter, Number 17, May 2017
with enhanced cone production. It is of utmost importance to quantify the genetic variability of traits related to cone and kernel production in different agro-climatic zones, in order to take advantage of regional selections.

Considering the topic of biotic risks and their impact on stone pine cone production, conclusive evidences were presented by different labs that the Western Conifer Seed Bug, *Leptoglossus occidentalis*, can considerably reduce the cone yield and quality in Mediterranean stone pine. The exotic insect has expanded its area since first detected in Italy in 1999 to most of Europe, as well as to the Maghreb and Western Asia. Several experimental studies have underlined the incidence and severe damages caused in conelets and seeds of stone pine by this pest, pinpointed as main causal agent of the Dry Cone Syndrome, a generalised conelet and seed loss observed in the last years in stone pine. This findings force the sector to face the challenge of developing an integrated pest management system for stone pine. Along with the seed bug, there are also endemic cone-feeding insects like *Dioryctria mendacella* and *Pissodes validirostris* that cause significant damages to cone production. A new pheromone will be available to monitor and control *D. mendacella*,...
but no similar options are yet available for L. occidentalis or P. validirostris.

Considering pine nut industry and markets, Portugal presented a new regulatory system for stone pine cones traceability which applies to harvesting, transport, storage, processing, and imports/exports, similar to already implemented regional traceability systems in several Spanish Autonomous Regions. As one important outcome, these regulations close the lack for knowledge and feasible data regarding annual cone production, agents/operators and circuits within the stone pine supply chain, in fulfilment of mandatory European Food Safety Regulation (EC) 178/2002. Cone and pine nut traceability from harvesting until final destination will not only enforce legality and hinder theft and black market, but it will allow for building consumers’ awareness of disparate pine nuts botanic species, origins and quality grades traded. Theft, lack of quality standards regarding adequate harvest seasons and cone processing, incorrect commercial labelling of pine nuts from different species, and speculation in cone or nut prices are considered currently important constrains for the competitiveness of Mediterranean pine nuts in global markets, a problem that requires the enforcement of due diligence and transparency in the trade of one of the most expensive nuts in the world.

AgroPine2016 meeting communications will be available on the event website http://agropine2016.iniav.pt/. The stone pine group within the FAO-CIHEAM cooperative research network on nuts will follow up the AgroPine cycle planning a next meeting for 2021.

Acknowledgements

The conference was organized by the FAO-CIHEAM Network on Nuts, together with the National Institute for Agrarian and Veterinary Research INIAV, the Federation of Forest Owners Associations UNAC, the School of Agriculture ISA (U. Lisbon), the Mediterranean Agronomic Institute of Zaragoza IAMZ-CIHEAM, the National Research Institute for Agriculture and Food Technology INIA, FAO Committee Silva Mediterranea, and the IUFRO Unit 1.08.00 on Silviculture for production of edible fruits. Sponsoring was given by ICNF IP, Cecilio S.A. and Companhia Agricola da Barrosinha S.A.

Contact: Sven Mutke, mutke@inia.es

TO BE HELD:

Hazelnut

Ninth ISHS Congress on Hazelnut
Date: 15-19 August, 2017
Place: Atakum, Samsun (Turkey)
Convener: Prof. Dr. Celal Tuncer, Ondokuz Mayis University, Faculty of Agriculture, Department of Plant Protection, 55139 Samsun (Turkey)
E-mail: celalt@omu.edu.tr
Tel: (90) 362 312 19 19 / (90) 362 457 60 34
www.hazelnut2017.org

Chestnut

Sixth ISHS Chestnut Symposium
Date: 9-13 October, 2017
Place: Samsun (Turkey)
Convener: Prof. Dr. Unit Serdar, Ondokuz Mayis University, Faculty of Agriculture, Horticultural Department. 55139 Samsun (Turkey)
E-mail: userdar@omu.edu.tr
Tel: (90) 362 312 19 19 / (90) 362 457 60 34
www.chestnut2017.org

This Congress was planned for 2016, but for unforeseen circumstances, it was postponed to 2017

Almond and Pistachio

Seven ISHS Symposium on Almonds and Pistachios
Date: 5-9 November, 2017
Place: Adelaide, South Australia
Convener: Michelle Wirthensohn, School of Agriculture, Food & Wine Plant Research Centre, Waite Campus, The University of Adelaide
Tel: +61 8 8313 6653
E-mail: michele.wirthensohn@adelaide.edu.au
www.isap2017.com.au

Walnut

Eight ISHS Walnut Symposium
Date: 28 November- 1 December, 2017
Place: Viña del Mar (Chile)
Convener: Dr. Juan Luis Vial, Chilenut . Apoquinto 4775 of 2002 Las Condes. 7580097 Santiago de Chile (Chile)
E-mail: chilenut@chilenut.cl

Carob tree

International Symposium on Carob , a neglected species with genetic resources for multifunctional uses (ISHS)
Date: 12-16 August, 2017
Place: Istanbul (Turkey)
Convener: Prof. Dr. Hamide Gubbux, Dept. Of Horticulture, Faculty of Agriculture, Akdeniz University, 07058 Antalia (Turkey)
E-mail: gubbux@akdeniz.edu.tr
Tel: (90) 242 3102422: FAX: (90) 242 2774564
www.ich2018.org

This Congress was planned for 2016, but for unforeseen circumstances, it was postponed to 2018

XVII GREMPA Meeting

Date: 2019
Place: Palermo (Italy)
Convener: Ettore Barone, Università di Palermo, Viale delle Scienze 11, 90128 Palermo (Italy)
E-mail: ettore.barone@unipa.it

Stone Pine

Meeting of Stone Pine: Agro Pine
Date: 2021
European Congress on Chestnut”, held in Debrecen (Hungary) from 9 to 12 October 2013. The Congress was organized by the Institute of Plant Protection at Debrecen University (Hungary), Institute of Forest Ecology SAV Zvolen (Slovakia) and Fruit Research Station of University of Craiova (Romania) under the auspices of the International Society for Horticultural Science (ISHS). Near 30 works on chestnut from around the world can be found in the proceedings.

PROCEEDINGS OF THE “SEVENTH INTERNATIONAL WALNUT SYMPOSIUM”. (Acta Horticulturae, 1050). This book includes the works presented in the “Seventh International Walnut Symposium”, held in Fenyang City, Shanxi Province, China from 20 to 23 July, 2013, under the auspices of the International Society for Horticultural Science (ISHS). The Organizers were the Pomology Institute, Shanxi Academy of Agricultural Sciences and the People’s Government of Fenyang City, Shanxi Province. Fifty seven works on walnut from researchers around the world, can be found in this Book.

PROCEEDINGS OF THE “EIGHTH INTERNATIONAL CONGRESS ON HAZELNUT”. (Acta Horticulturae, 1052). This book includes the works presented in the “Eighth International Congress on Hazelnut”, held in Temuco, in the Araucanian Region of Southern Chile, from 19 to 22 March 2012. The Congress was organized by the “Instituto de Investigaciones Agropecuarias” (INIA) Together with ISHS, and supported by public institutions as “Fundación para la innovación Agraria” (FIA), as well as private and local companies. More than 50 works on hazelnut from researchers around the world, can be found in this Book.

Establecimiento de plantaciones clonales de *Pinus pinea* para la producción de piñón mediterráneo [in Spanish - Installation of clonal *Pinus pinea* orchards as Mediterranean pine nut crop]. Mediterranean stone pine, *Pinus pinea* L, is an emblematic forest tree whose cones are harvested for their pine nuts, one of the world’s most demanded gourmet nut. Shortage of wild-collected cones has motivated a global increase in plantations for obtaining Mediterranean pine nuts from orchards. In the last 20 years, Turkey and Portugal have been leading this trend with more than 130,000 ha new stone pine plantations each, whereas 300,000 ha of older plantations with the species in Spain had been aimed mainly as protective and restorative forestation on wasteland, mountain slopes and dunes rather than as nut crop. Only recently, farmland set-aside has raised interest in Mediterranean stone pine in private landowners also in Spain, searching revenues from marginal agricultural lands. Farmers and forest owners’ associations are demanding grafted treelets that propagate improved genetic
In this context, a new book edited by the Spanish National Institute for Agricultural and Food Research and Technology INIA offers results from more than twenty years of research on genetic selection and propagation techniques for *Pinus pinea* and presents the first registered Spanish elite clones released in 2015. The book is structured in seven chapters. After a short introduction with references to published books on the species, stone pine is presented as forest nut tree, as well as past and present research and experiences that have advanced the domestication of this tree in grafted plantations. The European legal and regulatory framework regarding forest reproductive materials is summarised, because its fulfilment is mandatory for scions and grafted trees of stone pine. The register of fifteen Spanish elite clones in 2015, based on more than twenty years of experimentation in grafted field trials, will allow for the establishment of productive plantations with these improved genetic basic materials. The book resumes the experiences and knowledge gained by its authors, when developing since 1989 genetic improvement programmes of stone pine for the ministry of agriculture and regional forest administrations in Spain. The book also offers guidance for nursery production of grafted treelets and the installation of Mediterranean stone pine plantations as nut crop, including two appendices with technical prescriptions and cost calculation.

For purchase, please consult at http://libros.inia.es/.


---

**MANUAL DE PAUTAS TECNOLÓGICAS PARA LA PRODUCCIÓN DE AVELLANOS EN RÍO NEGRO J.P. Rolka; W.A. Ferrauti, D.M. Martin.** Book of 163p, in Spanish, published in 2014 by INTA (Instituto Nacional de Tecnología Agropecuaria), Argentina. The first introduction of hazelnut plants in Río Negro valley in Argentina, was in 1979. The production began to increase in the nineties, due to research carried out with this new species. Nevertheless, the lack of knowledge of this culture and the difficulty to find suitable plants from nurseries, limited the culture expansion. It was in 2011, with the establishment of the “Asociación del Cluster de Frutos Secos del Río Negro”, that the interest for this species increased and the surface of hazelnut plantations in this area of Argentina was triggered.

This book is the result of an intensive literature review worldwide and the professional experiences of the authors. The aim of the authors is that the book could be a support for hazelnut growers that must face different agronomic situations, to ensure a reasonable productivity level in this crop.

---

**HAZELNUT CULTIVARS.** The book Hazelnut Cultivars consists of two parts. In the first part, climate and soil requirements, as well as morphological and biological features of hazelnuts (*Corylus avellana* L.) are dealt with. The second part of the book is devoted to the description of standards for seventeen Turkish hazelnut cultivars, three recently released cultivars and a Turkish hazel tree species (*Corylus colurna*). Phenology, inshell and kernel nut characteristics, protein and fat content as well as color pictures of leaves, clusters, nuts and kernels are given. The book results from the collaboration of three institutions: the Hazelnut Research Institute (Giresun), the Ondokuz Mayis University (Samsun) and the Ankara University (Ankara), within the context of the Project for Improvement of Yield and Quality in Hazelnuts by the Trabzon Chambers of Commerce. The book, written in Turkish and in English, is expected to be useful for researchers and farmers.

**XVI GREMPA Meeting on Almonds and Pistachios.** This publication compiles 60 full articles of the contributions presented at the XVI GREMPA Meeting held in Meknès (Morocco) from 12-14 May 2015. The articles represent a good sample of the research currently carried out on the different aspects of breeding and genetic resources evaluation, crop managing and industrialization of almonds and pistachios in the Mediterranean basin.


CAROB


CHESTNUT


FAO-CIHEAM - Nucis-Newsletter, Number 17, May 2017
HAZELNUT


Farinelli, D. 2015. Influence of light and shoot development stage on leaf photosynthesis and carbohydrate status during the adventitious root formation in cuttings of Corylus avellana L. Frontier in Plant Science on 6 November 2015 http://dx.doi.org/10.3389/fpls.2015.00973 (I.F. 3,9) Volume 6, Number 973 ISSN=1664-462X.

NUTS


Rand, K.; Bar, E.; Ben Ari M., Lewinsohn, E.; Inbar, M. 2014. Mono - and sesquiterpene content of aphid-induced galls on Pistacia palaestina is not a simple reflection of their composition in...


**STONE PINE**


**WALNUT**


BOOKS


BOOK CHAPTERS


Santi, C. A multidisciplinary approach on nutragenetics and nutragenomics beneficial health effects of hazelnut enriched diet. ENEA Casaccia in collaboration with Tor Vergata University of Rome (Italy). Tutor L. Bacchetta and L. Di Renzo.


THESES


MASTER THESES


COURSES FINAL REPORTS

### THE FAO-CIHEAM INTER-REGIONAL COOPERATIVE RESEARCH NETWORK ON NUTS

<table>
<thead>
<tr>
<th>Network</th>
<th>Coordination Centre</th>
<th>Network Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nut tree crops</td>
<td>IRTA - Mas de Bover, Mediterranean Fruit Trees</td>
<td>M. Rovira</td>
</tr>
<tr>
<td>Genetic Resources</td>
<td>Ctra. Reus – El Morell, km 3.8, E-43120 Constanti (Spain)</td>
<td></td>
</tr>
<tr>
<td>Economics</td>
<td>Tel: 34- 977 328424 (Ext. 1615) Fax: 34- 977 344055</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-mail: <a href="mailto:merce.rovira@irta.cat">merce.rovira@irta.cat</a></td>
<td></td>
</tr>
<tr>
<td>Subnetworks</td>
<td></td>
<td>To be named soon</td>
</tr>
<tr>
<td>almonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IRTA - Mas de Bover, Mediterranean Fruit Trees</td>
<td>M. Rovira</td>
</tr>
<tr>
<td></td>
<td>Ctra. Reus – El Morell, km 3.8, E-43120 Constanti (Spain)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tel: 34- 977 328424 (Ext. 1615) Fax: 34- 977 344055</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E-mail: <a href="mailto:merce.rovira@irta.cat">merce.rovira@irta.cat</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazelnut</td>
<td>Ankara University, Faculty of Agriculture. Department of Horticulture. 06110 -</td>
<td>V. Erdogan</td>
</tr>
<tr>
<td></td>
<td>Ankara (Turkey). Tel: 90- 312 3170550. Fax: 90- 312 3179119 E-mail: verdogan@agri.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ankara.edu.tr</td>
<td></td>
</tr>
<tr>
<td>Walnut and Pecan</td>
<td></td>
<td>To be named soon</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pistachio</td>
<td>University of Harran, Faculty of Agriculture. Department of Horticulture. 53200 –</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sanliurfa, Turkey. Tel: 90- 414 247 26 97 Fax: 90- 414 247 44 80 E-mail: beak@</td>
<td></td>
</tr>
<tr>
<td></td>
<td>harran.edu.tr; <a href="mailto:baakbeki62@gmail.com">baakbeki62@gmail.com</a></td>
<td>B.E. Ak</td>
</tr>
<tr>
<td>Chestnut</td>
<td></td>
<td>G. Bounous</td>
</tr>
<tr>
<td></td>
<td>Università degli Studi di Torino. Dipartamento di Culture Arborée. Cattedra di</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arboricultura Via Leonardo Da Vinci, 44. 10095 Grugliasco (TO) - Italy. Tel: 39-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>011 6708653. Fax: 39- 011 6708658. E-mail: <a href="mailto:giancarlo.bounous@gmail.com">giancarlo.bounous@gmail.com</a></td>
<td></td>
</tr>
<tr>
<td>Stone Pine</td>
<td></td>
<td>S. Mutke</td>
</tr>
<tr>
<td></td>
<td>Centro de investigacion forestal CIFOR-INIA Ctra. La coruña km 7.5 - 28040 Madrid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Spain) Tel: +34 91 347 6662 Fax +34 91 347 6767 E-mail: <a href="mailto:mutke@inia.es">mutke@inia.es</a></td>
<td></td>
</tr>
</tbody>
</table>

### FAO

| FAO                      | Agricultural Research and Biotechnology Officer FAO Regional Office for Europe and   |
|                         | Central Asia Benczur utca 34, H1068 – Budapest, Hungary. Tel: (+36–1) 814 257 Fax: (+36–1) 351 7029. |
|                         | E-mail: nevena.alexandrova@fao.org                                                   | N. Alexandrova           |

### CIHEAM

| CIHEAM                  | Instituto Agronómico Mediterráneo de Zaragoza IAMZ. Apartado 202, 50080 Zaragoza, |
|                        | (Spain) Tel: 34- 976 71 60 00 Fax: 34- 976 71 60 01 E-mail: gabina@iamz.cieam.org |
|                        | E-mail: lopez-francos@iam.cieam.org                                                 | A. López-Francos         |

Network Coordinator: M. Rovira
Scientific Editor: M. Rovira
Editorial Committee: N. Aletà, I. Batlle
Editorial staff: A. López Francos
Typeset by: INO Reproducciones, S.A.
E-mail: coordinacion@ino reproducciones.com
ISSN 1020-0797