

SAFETY AND HEALTH OF WORKERS: EXPOSURE TO DUST, NOISE AND VIBRATIONS

D. Monarca, M. Cecchini, M. Guerrieri, M. Santi, R. Bedini

Dipartimento GEMINI, Università della Tuscia, Via San Camillo de Lellis – 01100 Viterbo (Italy).

Keywords: safety and health, exposure during harvest, dust, noise, vibrations

Abstract

Working in nut farms results in the exposition of workers to different risks for their safety and health.

The use of agricultural machines exposes workers to risks which can have a physical (noise, vibrations), chemical (dust and chemical agents in the air, smokes) and biological nature (spores, micro-organisms, pollen, which are conveyed with the dust).

The harvest of nuts is different from the harvest of other fruits in that it is carried out with machines realized for that specific purpose, often by artisan manufacturer. For this reason, and because of the high concentration of work which characterizes the harvest, the research focused on this cultural operation and on the main risk factors for the health of the workers: noise, vibrations and dust.

The evaluation of the exposure to noise during harvest was performed with the aid of integrator phonometers, through which the sound pressure levels were measured in correspondence to the exposed workers' hear. The applied methodology was the one according to decree law 195/06, Italian reception of the directive 2003/10/ CE.

The evaluation of the risk given by exposure to vibrations for the workers was carried out separately for the vibrations transmitted to the whole body (WBV- Whole Body Vibrations) and those transmitted to the system hand-arm (HAV – Hand Arm Vibrations). The evaluations were performed according to decree law 187/05, Italian reception of the directive 2002/44/CE, based on norms ISO 5349 and ISO 2631.

With concern to the exposure to inorganic dust, tests on different harvest machines were carried out, with the objective of evaluating the exposure of workers. The samplings were performed with the aid of aspirating pumps SKC and "cone-shaped" samplers for breathable dust, on cellulose filters.

FUNGAL DISEASES AS AN IMPORTANT CAUSE OF LOSSES IN HAZELNUT CROP

P. Magro, C. Ciambella, E. Marcucci

Dipartimento di Protezione delle Piante, Università degli Studi della Tuscia, Via S. Camillo de Lellis – 01100 Viterbo (Italy)

Keywords: fungal diseases, hazelnut, losses of production

Abstract

Fungal diseases are still a considerable limiting factor of both quantitative and qualitative production of *Corylus avellana* L. growing in Central Italy. Among them, root rot, shoot cankers, wood decay, twig blight, fruit rot, anthracnose, grey necrosis and powdery mildews are particularly important. The first critical step in the hazelnut crop occurs during the transplant, when the rootstock can be affected by several root rot fungal pathogens. The most dangerous hazelnut fungal disease seems to be still the "Cytospora canker" (mal dello stacco) associated with the presence of *Cytospora corylicola*. This is a necrotrophic pathogen which attacks stressed plants causing bark and cambium infection and necrosis; additionally, apoplexy, blight and shoot cankers appear in the host. The presence of other 2 fungal species (*Biscogniauxia mediterranea* and *Phomopsis* sp.) was detected during 3 years of survey in hazelnut farms with a high incidence of *C. corylicola*. The monitoring results show that this disease has a chronic trend and leads to a strong decline in production. The measured losses were as follows: -35% in 2004, -38% in 2005, -34% in 2006. Moreover, a low, constant level of qualitative loss, ranging from 3% to 5%, in shelled nuts was found. Through mycological investigations carried out into buds, flowers and nuts, *Fusarium lateritium*, *Alternaria* spp., *Epicoccum* spp., *Phomopsis* sp., *Penicillium* spp. and *Aspergillus* spp. were identified. The last two fungi (which are of considerable interest due to their ability to produce mycotoxins) were actually toxin producers only in 0.5% of total cases. Recommended control measures are: replacement of old weakened plants, use of pathogen-free propagating material, preference to single-trunk tree, regular application of scouting for new cankers, therapeutic pruning, infected residual removal, fungicide treatments.

TEBUCONAZOL EFFICACY IN THE CONTROL OF
“GREY NECROSIS” OF HAZELNUT

P. Magro⁽¹⁾, *E. Marcucci*⁽¹⁾, *M. Egitto*⁽²⁾

⁽¹⁾ Dipartimento di Protezione delle Piante, Università degli Studi della Tuscia, Via S. Camillo de Lellis - 01100 Viterbo (Italy)

⁽²⁾ Dottore agronomo, Caprarola, Viterbo (Italy)

Keywords: tebuconazole, grey necrosis, hazelnut

Abstract

The aim of this study is to evaluate the action of tebuconazole (Folicur® SE Bayer CropScience) in the control of “grey necrosis” of hazelnut. This disease causes a brown-greyish spot at the base of the nut which progresses into the fruit with the discoloration of the pericarp and the embryo tissues. The “grey necrosis” of hazelnut is caused by many different fungal genera: *Fusarium lateritium*, *Alternaria* spp., *Phomopsis* spp. In 2006 and 2007, trials were made in two farms in the district of Viterbo (Central Italy). In each farm, the experimental hazel field was subdivided in trial plots corresponding to three experimental thesis (1 = no treatment ; 2 = tebuconazole; 3 = conventional chemical treatment). In each year, two treatments were made with tebuconazole, respectively in the first and in the last week of May (a period in which hazel plants seem to be more susceptible). During the first year only the productive data were determined. In the second year, samples of fruit, taken in different growth stages, were analyzed in Petri dishes with PDA as substrate. The developing fungal colonies were isolated, studied under microscopy, identified and counted. The results show the lower presence of *F.lateritium*, *Alternaria* spp., and *Phomopsis* spp. in theses treated with tebuconazole. Mycological analysis demonstrated a good efficacy of tebuconazole in the control of the agents of “grey necrosis” of hazelnut (in particular *F.lateritium* and *Alternaria* spp.). In conclusion, hazel plants treated with tebuconazole give better results than the conventional treatment in terms of production and quality of product.

REMOTE SENSING IN MONITORING THE DIEBACK OF HAZELNUT ON THE “MONTI CIMINI” DISTRICT (CENTRAL ITALY)

A. Fabi, L. Varvaro

Dipartimento di Protezione delle Piante, Università degli Studi della Tuscia, Via S. Camillo de Lellis - 01100 Viterbo (Italy) and Centro Studi e Ricerche sul Nocciolo, Viale Trieste 127, 01100 Viterbo (Italy)

Keywords: dieback, GIS, remote sensing, hazelnut diseases

Abstract

During the last years, new methodologies for remote analysis, such as the remote and proximal sensing, have been added to the various standard techniques for plant disease monitoring. In particular, multi-spectral images, acquired at a high radiometric and geometric resolution, by means of digital airborne systems or by satellite, can be useful for monitoring some diseases of woody plants. This work first reports the results of the application of one of these systems, called A.Sp.I.S. (Advanced SPectroscopic Imaging System) for monitoring the Dieback of hazelnut in the province of Viterbo, as a case study. This is a bacterial disease which affected hazelnut orchards in province of Viterbo since the 1980s. The spatial data sources were aerial photographs taken during a decade of growing seasons, from 1996 to 2006. Moreover, satellite images (Quick Bird) were used in order to previously scan wide areas of the territory affected by the disease. The satellite images, once overlaid and manipulated by means of a dedicated software (Image calculator – IDRISI™), were used as a basis for drawing new elaborated “differential” digital images. The digital elaboration showed annually, in different grey scales, the plants which were suspected to have died the season before. The suspected plants were then automatically identified by means of E-cognition™, a segmentation GIS software which performs object-oriented image analysis. The results were then confirmed comparing the A.Sp.I.S. images and by proper ground activities performed *in loco*. The software was able to recognize the main part of dead or wilting plants when applied to the images. Finally, a protocol of investigation was set up, by means of vectorial GIS, in order to follow in time and in the space the local spread of the disease. The potential of such applications for our purposes is currently under validation. Moreover, the possibility of using these techniques to other agro-forestry environments is of great interest.

INTEGRATED PEST MANAGEMENT IN FRENCH HAZELNUT ORCHARDS:
A GLOBAL APPROACH BASED ON RECENT STUDIES FOCUSING ON
OPTIMAL PEST MANAGEMENT STRATEGIES FOR
THE CONTROL OF *BALANINUS NUCUM* AND *PHYTOPTUS AVELLANAE*

E. Couturié⁽¹⁾, J.P. Sarraquigne⁽¹⁾, M.M. Fernandez⁽¹⁾, H. Breisch⁽²⁾

⁽¹⁾ Association Nationale des Producteurs de Noisette, Lamouthe BP 10, 47290 Cancon, France

⁽²⁾ Centre technique interprofessionnel des fruits et légumes, Centre de Lanxade, BP 21, 24130 Prignonrieux, France

Keywords: integrated pest management, chemical controls, entomopathogenic nematodes, beneficials, hazelnut weevil, filbert bud mite

Abstract

The French Hazelnut Growers Association (ANPN) prioritises efforts to reduce damage caused by insects and diseases affecting hazelnut orchards. In recent years, three different pest management approaches have been developed to control pest populations. The suppression of chemical insecticides (endosulfan and carbaryl) has left French hazelnut producers defenceless against *Balaninus nucum* and *Phytoptus avellanae*. Joint evaluations of new insecticides have been carried out with CTIFL (Technical Centre of Fruits and Vegetables) and SRPV (Regional Service of Plant Protection) since 2005. The results of these trials have demonstrated the effectiveness of new active materials which should now be given fast-track approval.

Used alone, biological controls were shown to be ineffective in controlling populations of weevil larvae in the soil, with entomopathogenic nematodes and parasitic fungi. However, combining their use with chemical sprays could restrict the pressure of the pest and limit the need for chemical intervention.

The study of beneficials present in hazelnut orchards and their responsiveness to chemical treatments should allow pest management calendars to be adjusted with new pesticides efficient against pests and less harmful to the environment.

At present, pesticides offer the only means to ensure the economically viable production of hazelnuts in France. However, although the new active materials have a less impact on the environment and are less harmful to human health, their use has not been authorised yet and growers are therefore unable to take advantage of them.

For this reason, we have to continue investigating alternative methods of pest control. To bring together resources and know-how in the area, ANPN recommends the establishment of an international working group and is actively seeking contributions from potential scientific and technical partners who are willing to participate in such a project.

FIRST SURVEYS ON *AGRILUS* SPP. (COLEOPTERA: BUPRESTIDAE)
INFESTING HAZELNUT IN NORTHWESTERN ITALY

M. Corte⁽¹⁾, *S. Moraglio*⁽²⁾, *L. Tavella*⁽²⁾

⁽¹⁾ CReSO – Consorzio di Ricerca Sperimentazione e Divulgazione per l'Ortofrutticoltura Piemontese, Corso Nizza n. 21 – 12100 Cuneo (Italy)

⁽²⁾ Di. Va.P.R.A. Entomologia e Zoologia applicate all'Ambiente "C. Vidano", University of Torino, Via L. da Vinci n. 44 – 10095 Grugliasco (TO) (Italy)

Keywords: wood-boring beetle, field surveys, life-history, egg-parasitoid, Hymenoptera Encyrtidae

Abstract

In the last years, severe attacks of wood-boring beetles, belonging to the genus *Agrilus* (Coleoptera: BUPRESTIDAE), have been reported in the hazelnut growing area of Langhe (Piedmont, NW Italy). Similar attacks were already observed and attributed to the species *A. viridis*, larvae of which can cause shrivelling of hazelnut branches with their strong wood-boring activity. Therefore, in 2006-2007, research was addressed to identify the *Agrilus* species present in the hazelnut agroecosystem of our region, to assess rate and harmfulness of their attacks, and to evaluate efficacy of egg-parasitoids, with the aim to implement effective and environment-friendly control tactics. From May to August, sampling was carried out weekly in hazel groves using yellow sticky traps, and by visual inspection of branches to collect adults and egg-patches, respectively. Seven *Agrilus* species were sampled: three only occasionally and four more frequently; among these last species, the most abundant and widespread was *A. olivicolor*. Adult beetles were always captured from May to early August, showing a long flight activity in the hazelnut agroecosystem. Egg-patches were collected starting from May, and larvae emerged from late May to mid-July. An egg-parasitoid, *Oobius zhaikevitshi* (Hymenoptera: Encyrtidae), was obtained from egg-patches in both years; in 2007, the parasitization rate fluctuated from 8% to 58% of total field-collected egg-patches in the surveyed hazel groves.

EUROPEAN SHOT-HOLE BORER (*Xyleborus dispar* F.): COMPARISON
BETWEEN CAPTURE WITH CHEMIO-CHROMOTROPIC REBELL® ROSSO TRAPS
AND MODIFIED MASTRAP® TRAPS

B. Paparatti, D. Bucini, S. Speranza

Plant Protection Department, Entomology, Tuscia University, Via S. Camillo de Lellis, 01100 Viterbo, Italy

Keywords: IPM, insect, scolitidae, European shot-hole borer, *Xyleborus dispar* F.

Abstract

Xyleborus dispar F. (Coleoptera, Scolytidae) is one of the key pests of the hazelnut tree in the Palearctic region. It is well-known that Rebell®rosso traps do not only capture the target species, but also numerous useful insects, thus causing great damage to the ecosystem. For this reason, a comparison was carried out between the Rebell®rosso trap and the Mastrap®L trap which was modified by us.

The results show that there was not a great difference regarding the total number of insects captured with the two types of trap. The Mastrap®L trap, which we modified, could be used in IPM programs for controlling the populations of shot-hole borers using the technique of mass trapping, as they not only capture the same number of insects as the Rebell®rosso traps, but they are also highly selective.

NEW OBSERVATIONS REGARDING THE BIOLOGY OF THE EUROPEAN SHOT-
HOLE BORER (*XILEBORUS DISPAR* F.) ON HAZELNUT TREES
IN NORTHERN LATIUM (CENTRAL ITALY)

B. Paparatti, D. Bucini, S. Speranza

Plant Protection Department, Entomology, Tuscia University, Via S. Camillo de Lellis, 01100 Viterbo, Italy

Keywords: insect, scolitidae, European shot-hole borer, *Xyleborus dispar* F.

Abstract

Xyleborus dispar F. (Coleoptera, Scolytidae) is one of the key pests of the hazelnut tree in many nations of the Palaearctic region. In this paper, some new aspects were defined on the biology and ethology of this insect.

The results show that the flight of the insect is particularly influenced by rainfall and temperatures (minimum and maximum). In rainy periods and/or with low temperatures, the flight of the insect is interrupted until the weather conditions improve. The coleopteran starts its flight with a temperature of 14°C; therefore, in central Italy, it is advisable to install traps for the mass capture of the insect at the beginning of March. By observing the spermathecae, we can deduce that the insect mates outside the galleries of proliferation.

SEVEN YEARS OF OBSERVATION OF THE PRESENCE OF DIFFERENT PLANT BUG
SPECIES IN THE HAZELNUT ORCHARDS
OF 'TONDA GENTILE DELLE LANGHE' IN PIEDMONT

C. Sonnati⁽¹⁾, F. Molinari⁽²⁾, V. Ughini⁽³⁾

⁽¹⁾ Asprocor Piemonte, Viale Europa, Alba (CN), Italy

⁽²⁾ Istituto di Entomologia e Patologia vegetale, Facoltà Agraria- Università Cattolica S.C., Via Emilia parmense, 84, 29100 Piacenza, Italy

⁽³⁾ Istituto di Fruttivitticoltura, Facoltà Agraria- Università Cattolica S.C., Via Emilia parmense, 84, 29100 Piacenza, Italy

Keywords: Plant bug frequency, hazelnut orchard characteristics, 'Tonda Gentile delle Langhe'.

Abstract

Since the end of the past century, the technical service for assistance to hazelnut growers united in the Associazione Produttori Corilicoli Piemonte (Asprocor) arranged a system to monitor the insect presence in hazelnut orchards by *frappage*. These controls were made to better address the phytosanitary treatments mainly against plant bugs. Indeed, this kind of insects represents the major cause of internal defects in the seeds.

With the *frappage*, during the last 7 years, the moving forms of the following species of plant bugs were looked for and identified: *Acanthosoma haemorrhoidale*, *Coreus marginatus*, *Dolycoris baccarum*, *Gonocerus acuteangulatus*, *Palomena prasina*, *Pentatoma rufipes*, *Pantilius tunicatus*, *Graphosoma italicum*, *Rhaphigaster nebulosa*.

The *frappage* was performed in 80 farms, sited in 30 communes which represent 40 % of local production.

All the data give the possibility to determine, for each bug species, its frequency in relation to the year (that is to say, climatic conditions) and to the different yielding district, and orchard characteristics (e.g. nearness to other cultivations or to the wild).

These results should be useful not only to deepen plant bug ethology knowledge, but also to point out agronomic factors that support plant bug presence in hazelnut orchards.

BIOLOGY, POPULATION DENSITY AND FLUCTUATIONS OF THE GREEN SHIELD
BUG (*PALOMENA PRASINA* L., HETEROPTERA: PENTATOMIDAE)
IN HAZELNUT ORCHARDS OF TURKEY

İ. Saruhan⁽¹⁾, *C. Tuncer*⁽²⁾

⁽¹⁾ Selcuk University Sarayonu Vocational School of High Education, Sarayonu, Konya, Turkey

⁽²⁾ Selcuk University Faculty of Agriculture, Dept. of Entomology, 42075 Konya, Turkey

Keywords: hazelnut, *Palomena prasina* L., population, density, fluctuations

Abstract

There are many insect pests in hazelnut orchards. Some of the true bugs are important pests in hazelnut orchards because they feed on flowers, nuts and kernels. The most important species of this group is the Green shield bug (*Palomena prasina* L. Het.: Pentatomidae), both in Turkish hazelnut orchards as well as in some other countries. This species deserves great attention in relation to hazelnut production and kernel quality.

This study was carried out in order to determine population density and seasonal fluctuations of the Green shield bug in the Samsun, Ordu and Giresun provinces of Turkey between 2001 and 2003. Nine hazelnut orchards from the Samsun province were visited three times in a month during three years, while nine orchards of other provinces were surveyed twice a month during 2001. Adults and nymphs were collected through the beating sheet method. Eggs were found by examining leaves after the appearance of adults in field conditions.

The first overwintering adults were mostly seen in mid-April in hazelnut orchards. The new generation of adults appeared in July. The adults were present in orchards from mid-April until the end of October. The adult population density reached the highest level during August in general. Eggs were seen during May and June. Nymphs were mostly observed from June until the end of August in hazelnut orchards. The first two stages of nymphs tended to be on herbs in hazelnut orchards. Population density reached the peak level at the end of July and revealed as 10 insects/10 "ocak" (in Turkish "Ocak", which is consist of 8-10 sigle trunk together) in the Ordu province in 2001. The peak time of population density in the Giresun province was again late July and density levels were 15.2 insects/10 ocak in the same year. Population density reached the highest level in early August in the Samsun province for 3 successive years. Population levels were 14.9, 51.5 and 45.5 insects/10 "ocak" for 2001 and 2003 respectively.

In general, population density, fluctuations and biology of the Green shield bug changed depending on years and locations.

INTEGRATED CONTROL OF HAZELNUT WEEVIL (*CURCULIO NUCUM* L.): AN EVALUATION OF ENTOMOPATHOGENIC NEMATODES AND PARASITIC FUNGI

J.P. Sarraquigne, E. Couturié, MM. Fernandez

Association Nationale des Producteurs de Noisette, Lamouthe – 47290 Cancon (France)

Keywords: hazelnut weevil, biological control, entomopathogenic nematodes, *Heterorhabditis*, parasitic fungus, *Beauveria*, *Metarrizium*

Abstract

Since 2003 French hazelnut growers have been experimenting with alternative and/or complementary methods to the use of insecticides. In 2007 a biological control trial was carried out using containers with a capacity of 46 litres placed under a cold plastic greenhouse. The experiment has consisted of bringing a fungus or a nematode strain on the earth surface of containers where weevil larvae were recently buried. Larvae had been previously recovered with a grill system in which infected nuts were laid out. Larvae sowing was performed from 27 July to 13 August. 44 to 45 larvae were placed in each container. We used four products: Nematop® (*Heterorhabditis bacteriophora*, E-nema GmbH, Germany), Beaupro® (*Beauveria brongniartii*, Andermatt Biocontrol AG, Switzerland), Metapro® (*Metarrizium anisopliae*, Andermatt Biocontrol AG), Naturalis® (*Beauveria bassiana*, Intrachem Bio, Switzerland). Seven theses were investigated with respect to their efficiency : 1) untreated control, 2) Nematop at 1×10^6 IJs/sq.m, 3) Nematop at 1.35×10^6 IJs/sq.m, 4) Nematop with two applications 0.675×10^6 IJs/sq.m, 5) Beaupro at 10 g/sq.m, 6) Metapro at 10 g /sq. m, 7) Naturalis at 0.5 ml /sq. m. Fungi were applied on 28 May, the nematodes on 10 August (thesis 2 and 3) and the fractional treatment 4 was applied on 7 and 10 August. Each thesis was replicated in 5 containers, according to a complete randomisation. Observations on the efficiency against larvae were carried out from 27 September to 3 October, 2007. The proportion of recovered larvae or empty earth cells varied in a range between 30% and 55%, with a significant influence of treatments. Overall products efficiency was low relative to 8% rate of natural mortality observed in control plots. Nematop gave better results (23% to 37% efficiency) than fungi (15% to 18% efficiency). 66% of larvae were buried between 11 and 30 centimetres depth, and only 1.5% were buried deeper than 40 cm.

STRATEGIES FOR IMPROVED PEST MANAGEMENT
IN TURKISH HAZELNUT GROWING

S. K. Ozman-Sullivan⁽¹⁾, *G. T. Sullivan*⁽²⁾

⁽¹⁾ Faculty of Agriculture, Department of Plant Protection; Ondokuz Mayıs University (Turkey)

⁽²⁾ OYDEM, 55139, Samsun (Turkey)

Keywords: hazelnut, processing plants, storage pests, Turkey

Abstract

Turkey is the world's leading producer and exporter of hazelnuts. A hazelnut agro-ecosystem stretches across some 500,000 hectares of Turkey's eastern Black sea region. Substantial losses in production are attributable to pests. The main pests are the big bud mite *Phytoptus avellanae* and the hazelnut weevil *Curculio nucum*, with others locally important. The big bud mite has been reported to reduce yield by up to 70%. Hundreds of thousands of growers respond to pests with a wide spectrum of approaches, varying from non-intervention to organic growing and multiple chemical treatments. This paper reviews the range of current pest management practices and highlights opportunities for improved pest control through IPM and organic growing research, research and extension coordination, grower education and government policy changes.

CONTROL OF *CURCULIO NUCUM* L., THE HAZELNUT BORER,
BY ENTOMOPATHOGENIC NEMATODES

B. Blum⁽¹⁾, R.o Kron Morelli⁽²⁾, V.o Vinotti⁽²⁾, A. Ragni⁽²⁾

⁽¹⁾ Agrometrix ICM POB 18 CH -4009 Basel, Switzerland

⁽²⁾ Agrifutur srl, Parco Teconologico Padano, Via Einstein, 1 I-26900, Lodi, Italy.

Keywords: *Curculio nucum* L., *Heterorhabditis bacteriophora*, hazelnut, biological control, field application.

Abstract

Hazelnut borer *Curculio nucum* L. is a very harmful pest that can cause up to 80% of losses in hazelnut plantations. The pest is expanding fast, it is difficult to fight, as its larvae are protected in the nuts or in the soil, and few available insecticides are still authorised. Entomopathogenic nematodes from the genus *Heterorhabditis* are obligate parasite of insects: they have the ability to search and parasitize the prey in the soil. The attacked larvae died within two-three days and became a source of nutrients for the nematodes, which reproduce inside the preys' cadavers. In this work, we present the field application of an entomopathogenic-based product containing infective larvae of *Heterorhabditis bacteriophora* to control the hazelnut borer. Nematodes were applied by the end of July, when the larvae of *C. nucum* start falling on the soil. The number of applied nematodes was 500,000 infective larvae/m² distributed in one and two application times. The soil was irrigated before and after the application. Alternative treatments were performed by applying the nematodes with *Beauveria brognartii* and by applying another species of entomopathogenic nematodes, *H. megidis*. The efficacy of the treatments was assessed by scoring dead and alive larvae of the hazelnut borer buried in the field trials in tube cages. The best result, with 72% of efficacy, was obtained with two applications of *H. bacteriophora* at the rate of 250,000 larvae/m². *H. bacteriophora* is a valid tool to combat the infestation of *C. nucum* in hazelnut plantations and to safeguard the production economy. Its insecticidal activity reaches a high level of insect control, with a preventive action on the larvae before their development into adults. The entomopathogenic nematodes are safe for humans and the environment and they do not present residues.

NATURAL SPREAD OF *VERTICILLIUM LECANII*, AN ENTOMOPATHOGEN FUNGUS
OF BROWN SCALE
IN HAZELNUT ORCHARDS IN TURKEY

A. Atlamaz⁽¹⁾, B. Akbaş⁽²⁾, Ş.H. Er⁽²⁾, S. Uzunok⁽²⁾

⁽¹⁾ General Directorate of Agriculture Research, Yenimahalle - 06171 Ankara (Turkey)

⁽²⁾ Plant Protection Central Research Institute, Yenimahalle - 06172 Ankara (Turkey)

Keywords: biological control, hazelnut, fungus, scale

Abstract

Brown scale (*Parthenolecanium corni-rufulum*) is one of the major pest affecting hazelnut cultivation in Turkey. In addition to their direct damage, brown scale insects cause indirect damage to hazelnuts as they produce fumagine. Therefore, they cause an early ageing of hazelnut orchards. Due to their being polyphagous, their control is very difficult. In the past, chemical control was proposed against them. However, after the detection of *Verticillium lecanii* as an entomopathogen fungus of *P. corni*, chemical control was cancelled. In this study, natural spread and intensity of *Verticillium lecanii*, as well as the places where hazelnut cultivation is most effective against scales, were studied and determined.

ARTHROPOD PEST MANAGEMENT IN ORGANIC HAZELNUT GROWING

C.Tuncer

Selcuk University, Faculty of Agriculture, Dept. of Entomology, 42075 Konya, Turkey

Keywords: hazelnut, arthropods, insect pest management, organic growingAbstract

Organic agriculture has been growing very fast worldwide during the last decade. Hazelnut is one of the main crops produced as organic in Turkey. Most of the hazelnut produced organically in Turkey is exported. Unfortunately, organic production has not been supported adequately by rigorous research regarding arthropod pest management. Nowadays, approaches to arthropod pest management in organic production only consist of general pest control methods for many crops, as well as for hazelnut. However, many producers openly need more specific information addressed to their own crop and pest problems. In spite of the lack of sufficient information about pest management practices that can be used in organic hazelnut production, organic hazelnut growing is now continuing, and there is a need to evaluate available literature and experience in order to establish an arthropod pest management program for organic hazelnut production.

In this study, available results of researches and experiences about arthropod pests of hazelnut were evaluated, and control measurements for main arthropod pests were suggested for organic hazelnut growing. Cultural, mechanical and biological control methods of arthropod pests for organic hazelnut growing were discussed on the basis of pest species, in addition to the use of insecticides approved for organic systems.

ASSESSMENT OF GENETIC RELATIONSHIPS BETWEEN HAZELNUT CULTIVARS
USING RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD) MARKERS

M. Gantner, S. Okoń

Dept. of Entomology, Institute of Plant Genetics, Breeding and Biotechnology. Agricultural University,
K. Leszczyńskiego 7, 20-069 Lublin, Poland

Keywords: *Corylus avellana* L., genetic variability, random amplified polymorphic DNA (RAPD), PCR

Abstract

The objectives of this study is to assess the genetic variability between six hazelnut cultivars which grew in Poland using RAPD markers. DNA was extracted by Milligan's method from fresh leaves. Amplificated PCR products were separated on 1.5% agarose gel, visualized and photographed. 30 decamer primers were selected from 80 primers. This primers yielded a total of 243 bands, of which 146 were polymorphic. The total number of amplification products ranged from 2 to 12, with an average of 8.1 bands per primer. 21 primers amplified 31 unique bands for specific genotypes. Genetic pairwise similarities between studied genotypes were evaluated according to the Dice's formula. Cluster analyses were performed using the UPGMA method. The phylogenetic tree showed that only three cultivars clustered together. The rest of them were located on the outskirts of the dendrogram. This research showed that hazelnut cultivars in Poland are genetically diverse. The RAPD technique is an useful tool for the evaluation of genetic relationships between hazelnut cultivars.

A PRELIMINARY SURVEY OF HAZELNUT (*CORYLUS AVELLANA* L.)
VIRUS-LIKE DISEASE IN PORTUGAL: A CASE STUDY

A.P. Silva⁽¹⁾, *A. Assunção*⁽²⁾, *B. Gonçalves*⁽¹⁾, *I. Cortez*⁽³⁾, *A.M. N. Pereira*⁽³⁾

⁽¹⁾ CITAB – Centre for the Research and Technology of Agro-Environment and Biological Sciences. Universidade de Trás-os-Montes e Alto Douro, Vila Real (Portugal)

⁽²⁾ Direcção Regional de Agricultura e Pescas do Norte, Felgueiras (Portugal)

⁽³⁾ Plant Protection Department. Universidade de Trás-os-Montes e Alto Douro, Vila Real (Portugal)

Keywords: deformation trunk, hazelnut, rope symptoms, virus-like.

Abstract

Last year, several commercial hazelnut cultivars (*Corylus avellana* L.) located in the north of Portugal (Felgueiras region) on an antrosol at 370 m a.s.l. presented an unknown symptomatology. The local climate can be defined as temperate, with cold winters, mild springs and hot summers of the Mediterranean type. Rainfall reaches 1300 mm per year, although the summer season is generally dry. The trial was a rectangular field plot with 245 plants of 26 cultivars, twenty-years-old, spaced 5 x 3 m and trained as a single trunk. Only recently, 41 trees of different cultivars (Couplat, Grifol, T. G. delle Langhe, Ribet, T. G. Romana, Pauetet, L. d'Espagne, Siciliana, Casina, Da Veiga, S. Giovanni e Mortarella), some of them grafting onto Segorbe (just the first six cultivars), located at the centre of the trial, began to show external bark deformations at several branches and at the trunk; the deformations have a rope aspect and no symptoms were evident on the leaves. This type of bark deformations was also observed in several plants of *Camellia japonica* near to the hazelnut trial. The viruses reported on hazelnut cultivars, namely *Apple mosaic virus* (ApMV), *Prunus necrotic ring spot virus* (PNRSV) and *Tulare apple mosaic virus* (TAMV), usually do not induce these symptoms. *Apple stem grooving virus* (ASGV), which infects apples and citrus and *Citrus psorosis virus* (CPsV) in citrus, may induce similar deformations mainly in the trunk. The deformations observed suggest a vascular type of disease that could have a biotic or abiotic origin.

The objective of this work is to identify the causal agent of this virus-like disease or other non-biological cause. Biological, serological, molecular and electron microscopy studies, as well as nutritional analyses, will be prosecuted.

THE CONSUMPTION OF FRESH HAZELNUTS: QUALITY AND STORAGE

*R. Massantini⁽¹⁾, M. L. Mordacchini Alfani⁽²⁾, M. Guerrieri⁽²⁾,
D. Monarca⁽²⁾, M. Cecchini⁽²⁾*

⁽¹⁾ DISTA – Dipartimento di Scienze e Tecnologie Alimentari – Facoltà di Agraria – Università degli Studi della Tuscia Via S. Camillo de Lellis snc – 01100 Viterbo – Italy

⁽²⁾ GEMINI – Dipartimento di geologia e ingegneria meccanica, naturalistica e idraulica per il territorio Facoltà di Agraria – Università degli Studi della Tuscia – Via S. Camillo de Lellis snc – 01100 Viterbo - Italy

Keywords: hazelnut production, storage, quality, fresh consumption

Abstract

The cultivation of hazelnuts on the territory surrounding Viterbo represents a great source of work. The search for competition at a commercial level is achieved by reaching some priority objectives: the improvement of quality, the rationalization and simplification of the system of production, and, lastly, the promotion of consumption through a commercial increase in value of the product. It is in reference to the latter that there is good reason to believe in a different use of this fruit: the consumption of fresh hazelnuts.

As it is a fresh product, the main problem concerns storage and therefore it is necessary to evaluate the possibility of opening a new market; so, there is a need of maintaining the organoleptic qualities of the product over a period of time.

The aim of this experiment was to determine the best harvest time in relation to the organoleptic qualities of the fruit, and the most adequate methods of storage for the product. Hazelnuts were harvested at 3 different stages and the following analyses were carried out: deformation, colour, acidity, peroxides, weight loss and furthermore hazelnuts were evaluated by a trained panel test.

The fresh hazelnuts were therefore stored in a controlled atmosphere using different percentages of O₂ and CO₂, and 2 different temperatures: 4 and 10°C.

The best result was obtained using the lowest temperature, while the best harvesting time was when the deformation of the fruit reached 0.18 mm applying a compression force of 10N.

DETERMINATION OF RELATIONSHIPS BETWEEN NUT AND KERNEL
CHARACTERISTICS IN HAZELNUT (CV. PALAZ)

H. İ. Balık⁽¹⁾, N. Beyhan⁽²⁾

⁽¹⁾ Hazelnut Research Institute 28200, Giresun (Turkey)

⁽²⁾ Ondokuz Mayıs University, Department of Horticulture 55139, Samsun (Turkey)

Keywords: hazelnut, Palaz, regression analysis, pomology

Abstract

This study was carried out on Palaz hazelnut cultivar grown in villages of Ordu province. The interrelationships between nut weight, kernel weight, kernel percentage, shell thickness, nut size, marketable kernel and pellicle removal were determined using correlation analysis.

VARIATION OF IMPORTANT QUALITY CHARACTERISTICS IN HAZELNUT AT
DIFFERENT YEARS AND CORRELATIONS BETWEEN
HUSK NUMBER AND NUT AND KERNEL TRAITS

S. Z. Bostan, K. Günay

Ordu University, Faculty of Agriculture, Department of Horticulture, 52200 Ordu, Turkey

Keywords: hazelnut, nut, kernel, husk number, correlation

Abstract

This study involved 'Tombul', 'Palaz', 'Kalınkara' and 'Çakıldak' hazelnut cultivars grown at an altitude of 310 m in a flat orchard in Ordu province (Turkey) in 2000 and 2001. The experimental design was completely randomized with three replicates. In this experiment, the stems were 15 years old and the spacing between ocaks was 4 m and 5 m. Stem contour was determined at 50 cm from ground. Nut and kernel traits were nut weight (g), nut size (mm), shell thickness (mm), kernel weight (g), kernel size (mm), internal cavity (mm), kernel percentage (%), poor fill (%), shriveled kernels (%), blanks (%), good kernels (%), doubles (%), full pellicle removal (%) and average pellicle removal (%). In this study, it was found that husk numbers and blanks varied between years; nut weight, kernel weight, shriveled kernel and good kernel varied between cultivars; kernel size and full pellicle removal varied between years and cultivars; and nut size, internal cavity, kernel percentage, poor filled, doubles and average pellicle removal varied significantly between years X cultivars interactions. In addition, a significant positive correlation was observed between husk number and internal cavity; a significant negative correlation was noted between husk number- full pellicle removal and husk number- average pellicle removal.

STATE AND PROSPECTIVES OF HAZELNUT GROWING IN SERBIA

M. Mitrović, R. Miletić, M. Lukić

Fruit Research Institute, Kralja Petra I/9, 32000 Čačak (Serbia)

Keywords: hazelnut, production, leading producers, assortment, fruit qualityAbstract

A growing interest in hazelnut production has been observed in Serbia over the past decade. In terms of its ranking among other kernel fruits, hazelnut ranks second, just below walnut. Interest in hazelnut fruits is particularly observed in candy industry on account of its nutritive and aromatic properties. Wider growing of hazelnut is promising for many reasons. Firstly, shortage in hazelnut can be duly controlled. Secondly, growing technology is simple, and finally, hazelnut plantings are not prone to serious pests and diseases, which makes the production cheaper.

Leading global producers and exporters of hazelnut fruits are Turkey, Italy, Spain, USA, Greece, etc. As for Serbia, hazelnut production has not been registered yet, however, it is estimated to be about 800 – 1,000 t.

One of the most serious problems in wider growing of hazelnut in our country is shortage in respect of high quality planting material. Expansion of hazelnut growing in Serbia should be further supported by the assortment that will be adequate for growing under our agroecological conditions. In view of the fact, our recommendation should include the following cultivars: Tonda Gentile delle Langhe, TG Romana, Tonda di Gifoni, Nocchione, Tonda Bijanca, Mortarella, Negret, Ennis, Barcelona Istarski dugi, Haleški džin, Mogul, Multiflorum, Kosford, Lambert, Davijana.

The proposal meets requirements of the candy industry which presupposes expansion of cultivars with smaller and round fruits.

PERFORMANCE OF HAZELNUT VARIETIES IN IRAN

H. Sona⁽¹⁾, A. Imani⁽¹⁾, J. Davod⁽²⁾⁽¹⁾ Horticultural Research Department, Seed and Plant Improvement Institute (S. P. I. I.), Karaj, Iran⁽²⁾ Hazelnut Research station of Astara, Astara, IranKeywords: hazelnut varieties, fruit set, pollinationAbstract

Hazelnut is one of the oldest nut crops which is important as food. Hazelnut is cultivated in more than 20 countries. Iran is one of the biggest producers in the world . The purpose of this research is to evaluate qualitative and quantitative characteristics of 25 collected varieties during 2000-2004 in the research station of Kamalshahr. Characteristics such as date of catkins and female flowers appearance, pollen ripening and pollen shedding, appearance of stigma, type of flowering, leaf morphology, date of leaf abscission, browning of leaf margin, date of harvesting, fruit characteristics (length, diameter, weight, protein and oil content of kernel) and yield were studied. In this study, we found that the varieties are divided in 3 groups: protogyne, protander and homogame. It was found that Fertile du Cutard has the highest yield (1.4 Ton /ha), while the lowest yield recorded relates to Mahalie Karaj (0.2 Ton /ha). The studies on pollination and fruit setting showed that most of the varieties were cross pollinated and some had pollen compatibility, so the rate of fruit set in isolated flower has significant differences with open pollinated ones.

In this study, it was found that Rasmy and Fertil du Cortard varieties had the highest degree of self fertility, while varieties of Pashmineh and Gerge had the lowest.

Moreover, it was found that Gerdooii variety was an excellent pollinizer for the following varieties: Fertil du Cortard, Rasmi, Gerdooii, Shastak and Negret. Finally, among 25 varieties in this experiment, 9 varieties are compatible to Karaj conditions and the nuts present high quantity and quality in such a condition.

PRODUCTIVE AND ORGANOLEPTIC EVALUATION
OF NEW HAZELNUT CROSSES

D. Farinelli, M. Boco, A. Tombesi

Dipartimento di Scienze Agrarie e Ambientali, Università di Perugia, Borgo XX Giugno 74, Italy

Keywords: *Corylus avellana* L., cross-breeding, horticultural performance, sensory evaluation.

Abstract

This study presents the results of ten years of observation about the agronomic traits, the nut and kernel characteristics, and the sensory analysis of eight crosses of Tonda Gentile Romana and Tonda di Giffoni, selected during a hazelnut breeding program carried out since 1983 in Central Italy.

On the basis of the collected data, the most interesting crosses resulted to be the following:

- F6P200: for early nut maturity (last ten days of August, at the same time of Tonda Gentile delle Langhe), steady and high yield, few suckers, spheroidal nut, high pellicle removal (74%) and good flavour of roasted kernel;
- F15P5: for high yield, good kernel percentage (48%) and round index (0.91);
- F21P12: for good yield and very good kernel percentage (54%);
- F4P32: for few suckers, round index 1.02, high kernel uniformity (76%), high pellicle removal (75%), good flavour of roasted kernel;
- F25P29 and F13P9: for very good kernel percentage (around 51%).

The crosses F4P32, F25P29 and F13P9 showed very interesting nut characteristics, such as kernel quality and percentage, while yield must be improved by specific cultural techniques or by further breeding.

NUT QUALITY AND SENSORY EVALUATION OF HAZELNUT CULTIVARS

V. Cristofori⁽¹⁾, S. Ferramondo⁽¹⁾, G. Bertazza⁽²⁾, C. Bignami⁽³⁾

⁽¹⁾ Dipartimento di Produzione Vegetale, Università degli Studi della Tuscia, Via S. Camillo de Lellis snc, 01100 Viterbo, Italy.

⁽²⁾ Consiglio Nazionale delle Ricerche, Istituto di Biometeorologia, Sezione di Bologna, Via P. Gobetti 101, 40129, Bologna, Italy.

⁽³⁾ Dipartimento di Scienze Agrarie e degli Alimenti, Università degli Studi di Modena e Reggio Emilia, Via Amendola 2, pad Besta, 42100 Reggio Emilia, Italy.

Keywords: sugars, starch, fatty acids, phenol content, sensory analysis

Abstract

Nut quality depends on morphological, physical, chemical and organoleptic properties affecting the acceptance by industry and consumers, and the revenue for hazelnut growers. Sensory analysis gives a comprehensive evaluation of several quality components, allowing a deeper knowledge of varietal differences in nut external and inner quality.

The aim of this research is defining the quality of seven cultivars: the Italian Mortarella, Nocchione, San Giovanni, Tonda di Giffoni, Tonda Gentile delle Langhe, Tonda Gentile Romana, and the Turkish Tombul, through the study of biometric traits, chemical composition and sensory attributes of external appearance, texture and flavour. Nuts were sampled in a germplasm collection in the Italian province of Viterbo. Quantitative and qualitative determinations of sugars, organic acids and lipids revealed good nutritional and health potential of the nuts. The total content of oil and sugars ranged from 58.87 to 64.21 g 100g⁻¹ dry weight (DW) and 4.06 to 4.75 g 100g⁻¹ DW respectively. Fatty acid and sugar profile, starch and total phenolic content varied between cultivars, and a significantly higher palmitic acid concentration (7.46%) was found in the cultivar Tonda Gentile Romana, while a lower saturated fatty acid concentration and a higher unsaturated/saturated acid ratio (11.39) were observed in the cultivar Mortarella.

Multiple regression showed a significant positive relationship between global preference and taste and texture components, such as sweetness and oiliness. Sensory analysis was able to reveal varietal differences in attributes related to taste and smell. The perception of low sweetness and high bitterness and astringency determined a low level of appreciation for the cultivars San Giovanni and Mortarella. A positive relationship between sweetness scores and sugar concentration was observed. The information relating to secondary components, such as sugars, organic acids and phenolics was useful in order to discriminate between the cultivars. Due to the effect of these compounds on the sensory attributes perceived by consumers, their concentration and the varietal differences can be regarded as primary indexes of nut quality and should be taken into consideration when planning the cultivar choice.

SENSORY ANALYSIS AND HEADSPACE / GAS CHROMATOGRAPHY OF ITALIAN HAZELNUT VARIETIES

D. Farinelli, C. Zadra, C. Marucchini, A. Tombesi

Dipartimento di Scienze Agrarie e Ambientali, Università di Perugia, Borgo XX Giugno 74, Italy

Keywords: roasted hazelnut, descriptive sensory analysis, flavor, volatile compounds

Abstract

This study presents the preliminary results of the comparison of volatile components and sensory responses of Tonda Gentile Romana, Tonda di Giffoni and Mortarella cultivars. The sun-dried, natural hazelnut samples were roasted at 120°C for 20 min., using a hazelnut roaster (Brovid R1/900-OB-V). The characteristics of the roasted hazelnuts were described and evaluated by a panel made up by 8 tasters. Each taster tasted 3-5 hazelnuts at time and the panel test was done 3 times per each cultivar. Descriptive sensory analysis showed that Tonda Romana was mainly characterized by almond-like flavour, Mortarella hazelnut by oily taste and Tonda di Giffoni hazelnut by caramel-like flavour. The most important flavour attributes are nutty, caramel-like and cooked-bread-like. The taste and aftertaste attributes detected are sweet, salty, bitter, almond-like, nutty, burnt, oily. The bitter taste attribute was not detected in Tonda di Giffoni. Tonda di Giffoni showed the highest intensity of nutty aroma and of sweetness. The hazelnut varieties were characterized for their chemical composition of volatile components. Compounds including ketones, aldehydes, terpenes and cyanide derivatives were detected and identified by SPME-GCMS analyses. Among these classes of compounds, qualitative and quantitative differences were found in the different varieties. Specific compounds such as filbertone, linalool and 1.4 cineole showed significant variations between the three different cultivars. Therefore, the experimental results indicate that the combined DSA/GCMS technique is suitable for qualitative and quantitative analyses of hazelnut volatiles, and to support the sensory attributes in order to define hazelnut quality.

QUALITY AND NUTRITIONAL PROPERTIES OF HAZELNUT OIL AND HAZELNUT DEFATTED FLOURS

J.D. Coisson⁽¹⁾, G. Zeppa⁽²⁾, M. Arlorio⁽¹⁾, F. Travaglia⁽¹⁾, M. Giordano⁽²⁾, A. Martelli⁽¹⁾

⁽¹⁾ Dipartimento di Scienze Chimiche, Alimentari, Farmaceutiche e Farmacologiche & DFB Center. Via Bovio 6, 28100 Novara (Italy)

⁽²⁾ Dipartimento di Valorizzazione e Protezione delle Risorse Agroforestali, Sezione Industrie Agrarie, Università degli Studi di Torino, Via Leonardo da Vinci 44, 10095 Grugliasco, (Italy)

Keywords: hazelnut oil, defatted flours, nutritional properties, quality

Abstract

Hazelnut oil and partially-defatted flours from *C. avellana* seeds are two interesting products, under nutritional and technological point of view. These products are not largely commercialized in Italy; despite the deep knowledge about the chemical composition of hazelnut oil, the chemical characteristics of totally- or partially-defatted hazelnut flours have not been investigated until today. The roasting process strongly influences the quality and the stability of hazelnut seeds during their shelf-life, concerning the peroxidation of the lipid fraction. Different binomial time-temperature programs lead to different impacts on hazelnut products.

Our aim was to characterize some samples of hazelnut oil and some partially-defatted hazelnut flours, obtained with a cold pressing technology from TGL cv. Concerning oil samples, different roasting degrees were evaluated, confirming a strong impact on the tocopherols fraction; beta- and gamma-tocopherols showed a decrease from 2.47 mg/100g (oil from raw seeds) to traces; alfa-tocopherol decreased up to 19.5% (in oil samples from seeds roasted using high-temperature).

Partially-defatted hazelnut flours (10-30% fat) showed an interesting amino acidic profile (very similar to those of unroasted seeds); an interesting amount of branched chain amino acids were present, also in roasted flours (1.67, 2.45 and 1.31 g/100g, respectively for valine, leucine and isoleucine, in high roasted samples).

Nutritional quality of partially defatted hazelnut flour suggests its use as food ingredient useful to aromatise bakery products characterised by a low-fat profile.

DETECTION OF HAZELNUT (*CORYLUS AVELLANA* L.) AS HIDDEN INGREDIENT IN FOODS: PCR APPROACH VS ELISA

E. Cereti, J.D. Coisson, F. Travaglia, M. D'Andrea, C. Garino, M. Arlorio

Dipartimento di Scienze Chimiche, Alimentari, Farmaceutiche e Farmacologiche & DFB Center. Via Bovio 6, 28100 Novara (Italy)

Keywords: hazelnut allergens, end-point PCR, multiplex PCR, real-time PCR, competitive-Elisa

Abstract

“Food allergen detection ” is of increasing interest for food labelling purposes. With the Directive 2003/89/EC (up-dated by EU 2006/142/EC) it is mandatory for producers to label all ingredients and derived substances, highlighting the potential presence of food allergens. Hazelnut (*Corylus* spp.) contains different allergens (Cor a1-2, 8, 11) and may cause severe adverse reactions in sensitized subjects, even if in traces. Hazelnut allergens are thermal-resistant; their activity after roasting was highlighted in literature. Beside the traditional direct approach of detection (ELISA, immunoblotting) the use of PCR has been increasing up during the last years.

We aimed to evaluate the efficiency and the sensitivity of different analytical tests (*home-made* validated PCR protocols, commercial competitive-Elisa kits).

Firstly, an End-point PCR protocol (with positive inner control) was optimized. Two Real-time PCR protocols (the first based on Sybr-green unspecific dye, the second one based on a Taqman probe designed on Cor a1.04 gene) were then compared. Sensitivity and robustness were estimated on raw and roasted samples. The lowest detection limit was 0.1 ng of genomic DNA. Genomic DNA is partially degraded by roasting, allowing under-quantification in real samples. Also in the ELISA approach roasting hazelnut leads to some methodological troubleshootings.

Our results show that ELISA is a simple approach useful to detect trace of hazelnut in food; the ready to use kit showed high sensitivity and reliability. Real-time PCR protocols, based on Sybr-green or Taq-man chemistries, allow to obtain a more precise quantification of hazelnuts as ingredients in a complex food, showing a good reliability also in the case of roasted samples contained in traces.

PROANTHOCYANIDIN CONTENT AND TOTAL RADICAL SCAVENGING CAPACITY
OF TONDA GENTILE DELLE LANGHE (TGL) HAZELNUT SEED SKIN

*F. Travaglia⁽¹⁾, J.D. Coisson⁽¹⁾, M. Arlorio⁽¹⁾, M. Locatelli⁽¹⁾, M. Bordiga⁽¹⁾,
R. Bennett⁽²⁾, C. Stévigny⁽³⁾, A. Martelli⁽¹⁾*

⁽¹⁾ Dipartimento di Scienze Chimiche, Alimentari, Farmaceutiche e Farmacologiche & DFB Center. Via Bovio 6, 28100 Novara (Italy)

⁽²⁾ Universidade de Trás-os-Montes e Alto Douro, Apartado 1013, Vila Real (Portugal)

⁽³⁾ Laboratoire de Pharmacognosie, de Bromatologie et de Nutrition Humaine (CP 205/9), Université Libre de Bruxelles, Boulevard du Triomphe, 1050 Brussels (Belgium)

Keywords: hazelnut skin, proanthocyanidins, total antioxidant capacity

Abstract

The aim of this work is to qualitatively define the proanthocyanidinic fraction contained in the seed skins of TGL hazelnuts (Piedmont, Italy) and to evaluate the antioxidant properties.

Polyphenolic compounds are widely distributed in higher plants and are an integral part of the human diet. Recent interest in polyphenols has been stimulated by their potential health benefits, which are believed to arise mainly from their antioxidant activity. The antioxidant activity of flavonoids was studied in detail; a fundamental group of flavonoids is represented by proanthocyanidins, contained in high quantity in different common foods (i.e. grape, wine, berries, tea, cocoa, nuts). The bioactive properties of proanthocyanidins are strictly related to their antioxidant properties as well as to their degree of polymerization. The three most important mechanisms of their action are i) free radical scavenging activity, ii) chelation of transition metals, and iii) inhibition of some enzymes. Moreover, taking into account the organoleptic properties, proanthocyanidins are astringent substances able to allow a dry, puckering mouthfeel.

Hazelnut skins, a by-product directly obtained from hazelnut seeds after roasting, were previously chemically characterized in our laboratory, showing an interesting total content of polyphenols (ranging from 119.68 to 190.88 mg catechin equivalents/g hazelnut skins, dry weight) and an effective total antioxidant-antiradical capacity.

In this work the proanthocyanidin identification in phenolic extracts obtained from roasted hazelnut skin (two different roasting conditions) was performed using LC-MS and HPLC with fluorescent detection methods; we showed the presence of catechin-based procyanidins, with a typical polymerization degree up to dodecamers. Prolonged roasting time allows the decreasing of the polymeric fraction.

The total antioxidant capacity was evaluated as radical scavenging activity (DPPH and ABTS radical methods), chelating activity and inhibition of lipid peroxidation. The comparison with other antioxidant standard compounds confirmed a significant activity for roasted hazelnut skins. The application of the highest hazelnut roasting (180 °C, 20 min) appeared to improve the total antioxidant capacity in hazelnut seed skin.

IDENTIFICATION OF SOLUBLE PHENOLIC ACIDS IN HAZELNUT
(*CORYLUS AVELLANA* L.) KERNEL

S. Prosperini, D. Ghirardello, B. Scursatone, V. Gerbi, G. Zeppa

Dipartimento di Valorizzazione e Protezione delle Risorse Agroforestali – Settore di Microbiologia agraria e Tecnologie alimentari, Università degli Studi di Torino, Via L. da Vinci 44 – 10095, Grugliasco (Italy)

Keywords: phenolic acids, hazelnut, kernel quality, HPLC

Abstract

Phenolic acids are a subclass of a larger category of compounds commonly referred to as “phenolics”. They are a very important group of secondary plant metabolites whose roles are still unknown. Due to their antioxidant behaviour and the potential health benefits associated with these simple phenolic compounds, many authors have proposed different techniques to extract these compounds from vegetable foods. Therefore, the aim of this work is to compare the experimental conditions commonly used to detect soluble phenolic acids (both free and esterified) in order to investigate the phenolic constituents in hazelnut kernel extracts. Phenolic compounds present in defatted samples were extracted using different solvent mixtures under reflux conditions at different temperatures; afterwards, the extraction and hydrolysis of phenolic acids was performed. HPLC analysis of the extracts obtained highlighted the presence of twelve phenolic acids. The main compounds identified were gallic acid, caffeic acid, *p*-cumaric acid, ferulic acid and sinapic acid. In all extracts, gallic acid was the most abundant, in both the free and esterified form. Ethanol solution (80% v/v) at 80 °C was the most effective solvent for the quantitative extraction of benzoic acid derivatives, but extract obtained with acetone solution (80% v/v) at 50 °C showed the highest number of identified phenolic acids. All the other suggested methods showed low extraction capacity for these compounds. Using these optimized methods, new researches are in progress to define the effect of storage and roasting on these compounds.

EFFECTS OF STORAGE CONDITIONS ON HAZELNUT (*CORYLUS AVELLANA* L.) TEXTURAL CHARACTERISTICS

D. Ghirardello, L. Rolle, G. Zeppa

Dipartimento di Valorizzazione e Protezione delle Risorse Agroforestali – Settore di Microbiologia agraria e Tecnologie alimentari, Università degli Studi di Torino, Via L. da Vinci 44 – 10095, Grugliasco (Italy)

Keywords: textural analysis, hazelnut quality, shelf-life

Abstract

Texture analysis is a very important new tool to define the characteristics of foods as its responses could be correlated to consumer evaluations. In this work, texture analysis was applied to samples of the hazelnut variety “Tonda Gentile Romana” (*Corylus avellana* L.), harvested in 2005 and stored for one year in a refrigerating room, in a freezer and under a nitrogen-enriched atmosphere, in order to define the effect of these treatments on textural characteristics of the products. The analyses were performed on the fresh product and after 4, 8 and 12 months of storage. Raw and roasted products were examined. Rupture force (N), rupture energy (mJ) and nut specific deformation (N/mm) were measured by a Universal Testing machine TA.HDr Texture Analyser under three compression loading positions (x, y and z axes). In comparison to the fresh samples, the textural parameters showed the highest differences after 4 months of storage. After 12 months of storage, the values of the force required to break the nuts ranged from 84.8 to 103.1 N for raw hazelnuts and from 80 to 98 N for roasted. The lowest values of force were generally obtained in raw frozen hazelnuts, while in the same storage conditions roasted hazelnuts had the highest. The lowest values of rupture force were usually noticed along the x-axis (length), the highest along the y-axis (width). The obtained results showed that rupture force and nut specific deformation were the most discriminating parameters for raw hazelnuts, while rupture energy was the most discriminating parameter for roasted hazelnuts. Finally, rupture force was strongly correlated with both rupture energy ($R^2=0.95$) and nut specific deformation (0.94). These results show that texture analysis is a very suitable method for hazelnut analysis, and for the study of storage effects on the textural characteristics of this fruit.

FRACTIONS OF VITAMIN E (TOCOTRIENOLS AND TOCOPHEROLS)
IN NUT OIL OF *GEVUINA AVELLANA* MOL.

F. Medel⁽¹⁾, *R. Núñez*⁽¹⁾, *G. Medel*⁽²⁾, *H. Palma*⁽³⁾, *N. Manquian*⁽¹⁾, *R. Fuentes*⁽¹⁾

⁽¹⁾ Facultad de Ciencias Agrarias, Universidad Austral de Chile (UACH), Valdivia (Chile).

⁽²⁾ Facultad de Ciencias Forestales (UACH)

⁽³⁾ Facultad de Ciencias (UACH)

Keywords: *Gevuina avellana* Mol., vitamin E, tocopherols, tocotrienols

Abstract

The nut oil of *Gevuina avellana* Mol. (Gevuin), a tree native from Chile, has interesting results for phytotherapy and cosmetic purposes. Vitamin E plays an important role in the antioxidant complex of Gevuina nut oil together other components of the lipid matrix like unsaturated fatty acid isomers and phytoesters. Vitamin E is a fat-soluble vitamin that exists in different forms. Each form has its own biological activity, which is the measure of potency or functional use in the body. The objective of this study was to evaluate the content of different fractions of vitamin E (tocols: tocotrienols and tocopherols) in the nut oil of *Gevuina* clones. From 2006 to 2007, nuts from seven clones were analyzed to determine the tocol composition, with lipid extraction by Soxhlet method, HPLC and Gas Chromatography-Mass Spectrometry (GC/MS). The results demonstrated an important range of variation in total tocols among clones, with less average content in total tocopherols (1.42 µg/g). A significant level of α-tocotrienol, which represented 97 % of vitamin E fractions, ranged from 63.41 to 163.74 µg/g within clones. Other fractions were β, γ and δ tocotrienols with 1.08, 9.47 and 0.12 µg/g, respectively. These data are important in relation to the selection of genotypes with a superior antioxidant complex quality.

CHANGE OF RHEOLOGICAL, COLORIMETRIC AND AROMATIC
CHARACTERISTICS OF TOASTED HAZELNUTS DURING THE STORAGE AT
DIFFERENT TEMPERATURE AND GAS ATMOSPHERE

*D. De Santis⁽¹⁾, A. Fardelli⁽¹⁾, R. Forniti⁽¹⁾, S. Grosso⁽²⁾, G. Codone⁽²⁾,
P. Paliotti⁽²⁾, F. Mencarelli⁽¹⁾*

⁽¹⁾Dept. Food Science and Technology, University of Tuscia, Viterbo, Italy

⁽²⁾Elah-Dufour, Novi Ligure, Italy

Keywords: hazelnuts, storage, temperature, gas atmosphere

Abstract

Hazelnuts "Tonda Gentile delle Langhe" were toasted and divided in two lots one at 18°C for 4 weeks and the other lot at alterned temperature, one week at 18°C, the next one at 25°C, then one week at 4°C and the last one at 18°C. The samples were kept under nitrogen or in air. Analyses of resistance to compression (bioyield), of internal and external colour by spectrophotometer Minolta, and of volatile compounds were performed. Bioyield values were lower for hazelnuts kept continuously at 18°C in air, while samples in nitrogen, regardless the treatment, kept the bioyield values similar to the initial one. Hue angle of the surface decreased in all the samples due to the increase of "a" parameter. Internal hue angle decreased to a greater extent than the external one without differences between the samples. Acidity values, very low initially, increased slightly, but not in nitrogen samples. Peroxides increased with time, above all in air sample and in samples kept at alterned temperatures.

Two quality markers were identified, esanal and esanol, which increased in samples kept with alterned temperature.

INSTRUMENTAL TECHNIQUES FOR POMOLOGICAL CHARACTERIZATION AND HAZELNUT CULTIVAR CLASSIFICATION

G. Paglia, C. Costa, S. D'Andrea, I. Niciarelli, F. Pallottino, P. Menesatti

CRA-ING Unità di Ricerca per l'Ingegneria Agraria del Consiglio per la Ricerca e la Sperimentazione in Agricoltura – Via della Pascolare 16 – 00016 Monterotondo (RM)

Keywords: hazelnut, cultivar classification, shape, cultivar identification

Abstract

Qualitative characterization and cultivar identification are assuming a growing importance in agriculture. The assessment of these properties is important in order to deliver a product with specific characteristics that will satisfy industries and consumers' expectations. The most used technologies are based on visual evaluations, which are made considering reference models; therefore, they are subjective, and paired up with more complex methods based on bi- or three-dimensional fruit shape, which require high costs and time of acquisition.

This work tried to develop advanced and sophisticated instrumental methodologies, for an online rapid application, for pomological characterization and hazelnut cultivar classification. The research concerned 4 Italian cultivars: Tonda Giffoni, Tonda Gentile Romana, Mortarella, San Giovanni. In particular, the following analyses were carried out: morphological analysis of fruit and seeds (weight, size), consistence test (max force) obtained by a digital dynamometer, spectro-colorimetric evaluation and shape analysis. For the shape analysis, high resolution digital images of lateral view, polar view and random plane view for in-shell and kernel were acquired. The outline of each hazelnut was then processed by the elliptic Fourier analysis. The results evidenced that the cv. San Giovanni presents a significantly harder shell compared with the other three cultivars (ANOVA). The colorimetric test ($\Delta E > 6$, perceivable by human eye) showed important differences between the cultivars Tonda Giffoni, Tonda Gentile Romana and Mortarella. Moreover, cultivar identification *via* shape analysis showed good results of correct classification (PLSDA) for the random plane view of in-shell (87.8%). In conclusion, the studied methodologies, even if applied in a pilot research, could be considered as a base for a broader evaluation, keeping into account the possibility to operate an efficient classification and characterization for a merceological and qualitative product selection.

TRIALS ON DRYER FUNCTIONALITY IN THE FIRST CONDITIONING OF 'TONDA GENTILE DELLE LANGHE'.

V. Ughini⁽¹⁾, C. Sonnati⁽²⁾, G.L. Malvicini⁽¹⁾, A. Roversi⁽¹⁾

⁽¹⁾ Istituto di Fruttivitticoltura, Facoltà Agraria- Università Cattolica S.C., Via Emilia parmense, 84, 29100 Piacenza, Italy.

⁽²⁾ Asprocor Piemonte, Viale Europa-12051 Alba (CN), Italy

Keywords: small hot air dryers, hazelnut quality, 'Tonda Gentile delle Langhe'.

Abstract

In certain harvest seasons (e.g. rainy) and/or when the different hazelnut plots of the farm have very different harvest dates, or when the Grower Cooperative Plant for hazelnut conditioning is too distant, the grower suddenly faces the problem of drying sufficiently its production. A solution can be offered by farm drying using hot air dryers, possibly small and movable. The functionality of these dryers is not well known, and in particular no data are available for Piedmont and 'Tonda Gentile delle Langhe'. In order to determine their efficiency and control the influence of this first conditioning treatment on the principal traits of hazelnut, trials were carried out in the years 2004-2005.

In the hazelnut Cooperative plant of Cissone (Cn), 3 hot air dryers with similar device composition but with different capacity (increasing from 1 to 3 tons) were used. For 2 consecutive harvest seasons, 46 tons of hazelnuts, from 12 different farms of the Langhe, were dried with a single cycle of exsiccation (consisting in a heating phase followed by a ventilation one), for a total of 19 cycles. For each cycle, physic- chemical and commercial parameters were determined before, during or after the exsiccation, on the hazelnut samples or on their bulk in the silos. Therefore, initial moisture and physic and commercial traits of hazelnuts were determined before the exsiccation, whereas the duration of each phase and the trend of temperature and moisture of the hazelnut bulk were registered during the exsiccation. After the exsiccation, final moisture and physic and chemical (mineral composition and lipidic content) traits were determined, and a commercial evaluation was made.

Correlations between some important parameters and the regression model are proposed to check the efficiency of exsiccation.

The preliminary results of these trials point out the suitability of small dryers in lowering hazelnut moisture, especially the 2-ton one, while the hazelnut commercial and physical-chemical characteristics are not significantly different using the 3 types of dryers.

HIGH-TECH PRODUCTION OF BIOACTIVE α -TOCOPHEROL FROM *CORYLUS AVELLANA* ADVENTITIOUS ROOTS BY BIOREACTOR CULTURE

L.G. Sivakumar⁽¹⁾, M. Aramini⁽²⁾, C. Bernardini⁽²⁾, L. Bacchetta⁽²⁾

⁽¹⁾ Arkansas Biosciences Institute, USA

⁽²⁾ ENEA, Dipartimento Biotecnologie, Agroindustria e Protezione della Salute, Via Anguillarese 301, 00123 Roma

Keywords: hazelnut, tissue culture, Vitamine E, anticancer, antioxidant

Abstract

The *Corylus avellana* L. (hazelnut) contains potent antioxidant molecules such as vitamin E, which may represent a preventive measure against chronic diseases, including cardiovascular and Alzheimer's pathologies, and relieve aging symptoms. The most bioactive antioxidant vitamin E of hazelnut is α -tocopherol. The potential role of α -tocopherol, which is related with its antioxidant functions, has been investigated in the prevention of cancer. Humans do not synthesize α -tocopherol which is obtained from plant dietary intake or pharmaceutical products. However, the natural α -tocopherol isomer (RRR) seems to be assimilated in a more efficient manner than the enantiomer (SSS). The impossibility of obtaining the bioactive RRR- α -tocopherol by chemical synthesis for the nutraceutical demand makes biotechnologies a tool for industrial exploitation. Several secondary metabolites of pharmaceutical interest are accumulated into the roots. As an alternative to GMO, currently the adventitious root culture for the production of relevant bioactive therapeutic molecules represents a novel strategy from research laboratory to large-scale industrial application. In the present work, we report on the production of RRR- α -tocopherol by culture of *C. avellana* adventitious roots in bioreactors. The main goal was to optimize the conditions in order to obtain a high biomass of adventitious root production and elicitor (methyl jasmonic acid) concentration to enhance the target molecule accumulation. Among hormones, IBA seems to be more effective than NAA in promoting root growth; the biomass increased till the maximum level after 25 days of subculture. Moreover, methyl jasmonate strongly increased the production of α -tocopherol in adventitious roots: after a treatment of 100 μ M/L of methyl jasmonic acid for 5 days before harvesting, the bioactive antioxidant increased about 4 times. Thus, the established protocol for α -tocopherol production by means of bioreactors in hazelnut biofactories can produce natural vitamin E, which is pesticide-free, with reduced labour cost and year-round production.

IN-VITRO AND IN-VIVO ANTIOXIDANT POTENTIAL
OF PHENOLIC EXTRACTS OBTAINED
FROM HAZELNUT SKIN BY-PRODUCTS

S. Baccelloni⁽¹⁾, L. Manzi⁽²⁾, G. Anelli⁽¹⁾, M. Contini⁽¹⁾

⁽¹⁾ Dipartimento di Scienze e Tecnologie Agroalimentari, Università della Tuscia, Via S. Camillo De Lellis s.n.c., 01100 Viterbo, Italy.

⁽²⁾ Dipartimento di Ecologia e di Sviluppo sostenibile, Università della Tuscia, Largo dell'Università s.n.c., 01100 Viterbo, Italy.

Keywords: hazelnut skin by-product, natural antioxidants, antioxidant activity

Abstract

Recently, a growing interest in replacing synthetic antioxidants with natural ones has fostered research on the screening of plant materials in order to evaluate new antioxidants. Phenolic compounds are the major plant metabolites with antioxidant properties. Many of these can be potentially exploited as antioxidant agents and nutraceuticals.

The aim of this research was to evaluate the antioxidant potential of a crude phenolic extract obtained with 80% ethanol from hazelnut skin by-products by means of an improved extraction procedure. The extract was screened for *in-vitro* antiradical, reducing and chelating activity. Moreover, an *in-vivo* test carried out on rats was performed. The long-term stability of the extract dissolved in ethanol was tested during storage for six months at room temperature and under refrigerated conditions.

The results showed that the defatted hazelnut skin by-product is an excellent source of natural and very efficient phenolic antioxidants. The defatted skins provided a high yield in the crude extract (over 30%); the extract showed a very high phenolic content (743.5 mg gallic acid equivalent/g d.w.), high antiradical efficiency (superior to pure BHT, BHA, Trolox and α -tocopherol), Fe^{+3} reducing activity and Fe^{+2} chelating capacity. The *in-vivo* study showed an evident biological activity of the extract, which was able to improve the antioxidant potential of plasma in rats. The results of the storage tests showed that hazelnut skin extracts can be kept at room temperature for several months maintaining their antioxidant capacity high.

Because of their potential antioxidant and nutraceutical properties, phenolic extracts derived from hazelnut skin could satisfy the demand for new natural products in the preparation of innovative foods and beverages with a high dietetic/functional value.

ORCHARD ECONOMICS: THE COSTS AND RETURNS OF ESTABLISHING AND PRODUCING HAZELNUTS IN THE WILLAMETTE VALLEY - STANDARD VERSUS DOUBLE DENSITY

J. Julian⁽¹⁾, C. Seavert⁽¹⁾, J. Olsen⁽²⁾

⁽¹⁾ Oregon State University North Willamette Research and Extension Center, 15210 NE Miley Road, Aurora, Oregon, (USA)

⁽²⁾ Oregon State University Extension Service, 2050 Lafayette Avenue, McMinnville, Oregon, (USA)

Keywords: Hazelnut production costs, economics of establishment, standard density, double density

Abstract

As the Oregon hazelnut industry prepares to rejuvenate itself through the planting of improved varieties, this cost of establishment and production study provides growers with a tool for economic management and decision making. This study of the costs and returns of establishing and producing hazelnuts in Oregon's Willamette Valley is based on a 20-acre block of hazelnuts, with a standard tree spacing of 20 X 20 feet (6 X 6 m) which gives 108 trees/acre (269 trees/hectare). Yield and price assumptions include a price of \$0.70/pound (\$1.54/kg) or \$1,400/ton (\$1,543/metric ton). Commercial yields begin in the third year and full production of 2,800 marketable pounds/acre (1.4 tons/acre or 3.14 metric tons/hectare) is reached in year 12. In a standard spacing gross income exceed variable costs beginning in Year 5. An analysis of planting a double density orchard planted at 10 X 20 feet (3 X 6 m) showed the gross income minus the variable costs at a positive return in year 4 of \$210/acre (\$519/ha), compared to \$88/acre (\$217/ha) in year 5 for a standard density. A comparison of the cumulative cash flow show the double-density orchard covers all cash costs in year 8 with a surplus of \$598/acre (\$1,478/ha) while the standard density orchard shows a positive \$495/acre (\$1,223/ha) in year 10. Based on total cash costs and gross incomes in Table 9, the additional cash costs to plant a double-density orchard are \$1,883/acre (\$4,653/ha) and additional revenues are \$5,583/acre (\$13,795/ha) resulting in a net gain to the grower of \$3,700/acre (\$9143/ha). When an even higher density of trees are used as in 9 X 18 feet (2.7 X 5.5 m) thinned to 18 X 18 feet (5.5 X 5.5 m), the time it takes to cover all cash costs is accelerated. Planting a double-density orchard results in a higher economic benefit to the grower and therefore illustrates the usefulness of using this economic principle in hazelnut production to generate a greater return on investment.

A DISTRICT FOR HAZELNUT SECTOR: RURAL OR AGRO-FOOD SYSTEM?
ANALYSIS OF NATIONAL AND REGIONAL LAWS FOR THE GOVERNANCE OF
'MONTI CIMINI' TERRITORY

S. Franco⁽¹⁾, S. Marongiu⁽²⁾

⁽¹⁾ Dipartimento di Economia Agroforestale, Università della Tuscia, Via San Camillo de Lellis, Viterbo (Italy)

⁽²⁾ INEA Veneto, Via dell'Università 14, 35020 Legnaro (PD) - Italy

Keywords: district, territorial development, territorial governance, local systems

Abstract

Today, the analysis founded on agricultural systems is very useful in the territorial programming of characteristic regions. Using the scheme of "district" developed in the industrial economy studies (Marshall analysis), different kinds of models were used in the agricultural sector analysis. In Italy, national and regional laws were formulated taking into account the importance of a global and territorial approach in the local development.

More specifically, the National Law 228/2001 introduces two different ways to govern the territory: the rural and agro-food district. In particular, the first is used when there are many activities carried out in the territory, while the second is applied in presence of a sectorial specialization in some agricultural production. Consequently, the kind of interventions in the District Plan is different.

Lazio has individuated a district for Monti Cimini (Viterbo Province) with the Regional Law 1/2006. In this territory, hazelnut cultivation is one of the most important sectors, characterized by an high level of specialization (from the mechanical sector to the commercialization of products).

The objective of this study is to illustrate why the choice of the agro-food district for hazelnut rather than the rural district has been more adapted for Monti Cimini governance.

Starting from an analysis on rural concept, based on different indicators that measure a kind of "rurality degree" (defined using the population density and the services workers number of the General Population Census), the study put on evidence that the most rural areas of Viterbo Province are not those in which hazelnut sector is highly developed and specialized. So, in these last areas, the institution of an agro-food district seems more appropriate and could permit to carry out targeted intervention to support the hazelnut sector.

ECONOMIC RESULTS OF THE ORGANIC HAZELNUT CULTIVATION

S. Franco, B. Pancino

Dipartimento di Economia Agroforestale, Università della Tuscia, Via San Camillo de Lellis, Viterbo (Italy)

Keywords: organic agriculture, cultural account, hazelnut market

Abstract

In order to analyze the economic results of the hazelnut cultivation in an organic regime, two productive techniques were reconstructed. The two typologies, due to the different level of inputs, can be considered as “extensive” and “intensive”. The extensive technique is characterized by low-specialized plantations situated in less suited areas, whose yield is 1.5 ton/ha on average. On the contrary, the intensive technique is adopted in farms whose land dimension and configuration allow a greater mechanization of the cultivation. In these cases, higher yields are obtained, 2.4 ton/ha on average with maximum peaks of 3 ton/ha, thanks to repeated interventions with fertilizing technical means and pesticides, too.

Costs and productive value were evaluated for the two techniques and, afterwards, a comparison with the conventional management was carried out, referring to a representative technique which allows to achieve average yields of 2.7 t/ha, with a yield point slightly higher than the one which can be obtained in an organic regime (0.42 vs 0.40).

The cultural account elaboration highlights a substantial homogeneity in variable costs, which are slightly higher than 1,000 €/ha for all the three techniques considered, although remarkable variations can be observed in the different categories (raw materials, mechanization, work).

On the contrary, the production which can be sold varies remarkably according to the different orchard management forms. Such a thing is linked to the price dynamic, and depends as well on the premium price and on the presence of public aid. With concern to hazelnut prices, in particular with reference to the last decade, an extremely uncertain trend is registered, and it is linked in a great way to the offer conditions of the Turkish product. The price of organic nuts results to be 15-20% higher than the one of conventional nuts on average; yet, this premium price is effective only at the beginning of the campaign; whereas, in the following months, conventional nuts, following the market trend, are subject to further price reductions or can even reach an higher price than the one of organic nuts.

A comparison of margins shows that the result of the conventional management is intermediate between those of the two techniques in an organic regime. This result justifies the contrasting opinions of hazelnut producers on the relative convenience of the two management forms. The only certainty is that, when the organic hazelnut production is able to guarantee better economic results, it depends exclusively on public aid.

RISK ATTITUDES OF ORGANIC AND NON ORGANIC HAZELNUT PRODUCERS IN SAMSUN PROVINCE OF TURKEY

V. Ceyhan, K. Demiryurek

Ondokuz Mayıs University, Faculty of Agriculture, Department of Agricultural Economics, 55139
Samsun (Turkey)

Keywords: organic agriculture, hazelnut, risk attitudes, barriers for conversion, Turkey

Abstract

The purposes of this research are eliciting and comparing the risk attitudes of organic and non-organic hazelnut producers, as well as determining the additional barriers to their risk attitudes towards conversion to organic agriculture in the Turkish province of Samsun.

The Equally Likely Certainty Equivalent (ELCE) model was used to elicit utility for producers. The data used in this study were collected by using a structured survey both for 64 randomly-selected, non-organic producers and for all organic hazelnut producers (39) in the research area.

The results of the research revealed that organic hazelnut producers were more risk-loving than non-organic producers. It was also found that the variables of operators' education level, farm income, total capital, time allocated to activities outside the farm, farm land area, size of hazelnut orchard, number of hazelnut plots and total information score were other barriers to the conversion to organic hazelnut production, in addition to the producers' risk attitudes.

Providing better extension services and farmer training activities relating to organic agriculture and land consolidation, focusing on raising the educational level of producers, facilitating producers with greater access to credit to increase farm land and to enhance farm assets, are factors which may accelerate the process of conversion to organic hazelnut production.

IMPACT OF A NEW PRICE SUPPORT POLICY ON THE TURKISH HAZELNUT INDUSTRY

A. D. Spaulding⁽¹⁾, Ö. Tulum⁽²⁾, S. Saghaian⁽³⁾, G. Özertan⁽⁴⁾

⁽¹⁾ Illinois State University, Department of Agriculture, 132 Ropp Agriculture Building - 61790-5020 Normal, IL (USA)

⁽²⁾ National University of Ireland Galway, Center for Innovation & Structural Change, J.E. Cairnes Graduate School of Business & Public Policy - Galway, (Ireland)

⁽³⁾ University of Kentucky, 314 Charles E. Barnhart Bldg. - 40546-0276, Lexington, KY (USA)

⁽⁴⁾ Bogazici University, Department of Economics - 34342 Bebek, Istanbul (Turkey)

Keywords: new hazelnut price subsidy policy, hazelnut market efficiency, vector error correction model, Turkish hazelnut production

Abstract

In this research, time-series analysis and periodic decomposition based on monthly prices received by farmers and export prices are used to address the dynamics of price adjustment and causality along the Turkish hazelnut marketing channel. In this paper, the impact of eliminating price subsidies on the Turkish hazelnut sector is investigated by focusing on the short-run dynamics of price adjustment and price transmission along the Turkish hazelnut marketing channel to see whether the new policy brought by an agreement with the World Bank affected the price margins along the supply channel.

Considering the fact that in recent years food industries faced notable structural changes and an higher market concentration, an important research question is to what extent the new policy change/shock in the Turkish hazelnut sector was transmitted through the supply chain and impacted prices at farm and export levels. Market concentration and the likely presence of market power can potentially influence the degree and dynamics of price transmission, leading to differential price effects on different stages of the chain. The data, historical hazelnut market prices received by farmers and hazelnut export prices, were gathered from the producer cooperative (Fiskobirlik), the Turkish Statistical Institute (Turkstat), and the Turkish Hazelnut Commodity Exchange Market. The study also employs a vector error correction (VEC) model along with directed acyclic graphs and periodic decomposition to investigate the dynamics of price transmission along the Turkish hazelnut supply chain. Not only does the VEC model allow us to estimate the short-run speed of adjustment for the price series, but it also preserves the long-run relationships among the variables. Co-integration is also used as a tool to evaluate market efficiency and it can analyze both perfect and imperfect market conditions.

RECENT DEVELOPMENTS IN TURKISH HAZELNUT MARKETS

M. Bozoğlu

Ondokuz Mayıs University, Faculty of Agriculture, Department of Agricultural Economics, 55139 Samsun (Turkey)

Keywords: hazelnut market, recent developments, liberalization, Turkey

Abstract

The aim of this paper is to examine and make a general evaluation of the Turkish hazelnut sector with concern to production, industry, domestic marketing, export and import, and government policy during the 2000-2008 period. Turkey provides about three-quarters of hazelnut production and four-fifths of hazelnut export in the world. Hazelnut plantations in Turkey are about 640,000 hectares, a number which is estimated to be even higher, and production reached over 700,000 tons in the last years. However, domestic consumption (70,000 tons) and export (500,000 tons) are lower than this production potential. The Turkish government intended to liberalize hazelnut markets since the beginning of 2000. Therefore, it stopped the price support system and substituted it with direct incomes, gave financial independence and administrative autonomy to the Hazelnut Sale Cooperatives and FISKOBIRLIK, and encouraged alternative crops instead of hazelnut. Nonetheless, the government had to intervene in hazelnut markets through the Turkish Grain Board in 2006 because of potential hazelnut surpluses in the market, lack of competition, and absence of new instruments to compensate the farmers' losses.

LIST OF AUTHORS

A

Achim, G.	112
Akbaş, B.	70, 155
Akça, İ.	65
Akkak, A.	40
Aleandri, M.P.	66
Alvear, M.	125
Anelli, G.	177
Aramini, M.	97, 176
Arlorio, M.	75, 167, 168, 169
Armengolli Ferrer, F.	48
Assunção, A.	158
Atlamaz, A.	70, 155
Avanzato, D.	19
Aygun, A.	36, 52
Azarenko, A.N.	22

B

Baccelloni, S.	177
Bacchetta, L.	19, 97, 176
Bacelar, E.	42
Baldwin, B.	24, 38
Balık, H.I.	20, 160
Bassil, N.	27, 28
Bedini, R.	142
Belisario, A.	67
Bellahirech, A.	61
Bellincontro, A.	76
Beltramo, C.	40
Bender Özenç, D.	51, 53, 131, 135
Benedetti, A.	133, 134
Bennett, R.	169
Bernardini, C.	176
Bertazza, G.	165
Beyhan, N.	20, 21, 160
Bignami, C.	49, 50, 165
Bijelić, S.	118, 119
Blum, B.	154
Boccacci, P.	19, 102
Boco, M.	164
Bordiga, M.	169
Bostan, S.Z.	37, 132, 161
Botta, R.	19, 40, 79, 102, 126
Botu, I.	106, 112
Botu, M.	27, 106, 112
Boyko, A.L.	116
Bozoğlu, M.	93, 183
Breisch, H.	60, 146
Brunetti, A.	30
Bucini, D.	148, 149
Bustamante, C.	125

C

Caboni, E.	115
Cacka, J.	54, 55
Caligiani, A.	75
Calizzano, F.	126
Cammilli, C.	50
Capik, J.M.	23
Carelli, P.	117
Carnide, V.	105
Catarcione, G.	114
Caviglione, M.	41, 110, 124, 126
Cecchini, M.	56, 83, 141, 142, 159
Cedrola, C.	137, 139
Celik, N.	71
Cereti, E.	168
Cerović, S.	118, 119
Ceyhan, V.	89, 181
Chambers, U.	64
Chase-Lansdale, C.	81
Cheng, L.	98, 99
Chilosi, G.	66
Ciaffi, M.	114
Ciambella, C.	66, 143
Codone, G.	173
Coïsson, J.D.	167, 168, 169
Colantoni, A.	83
Colopardi, F.	56
Colorio, G.	137, 139
Comte, A.	61
Contessa, C.	126
Contini, M.	177
Correia, C.	42
Corte, M.	126, 147
Cortez, I.	158
Costa, C.	43, 174
Couturié, E.	60, 61, 146, 152
Cristofori, V.	49, 50, 107, 117, 165

D

D'Andrea, M.	168
D'Andrea, S.	174
D'Oria, M.	110
Damiano, C.	115
Davod, J.	82, 163
De Luca, A.	111
De Pace, C.	29, 104, 114
De Salvador, F.R.	16, 43, 77, 103, 127
De Santis, D.	173
Delfini, M.	77
Dell'Abate, M.T.	133, 134
Demir, I.	88
Demiryurek, K.	89, 90, 181

Destefanis, M.L.	40
Di Bartolomeo, E.	133, 134
Di Giammatteo, V.	97
Di Giovanni, B.	19
Dimalcunal, T.	129
Dolgov, S.	35
Dong, D.	25
Dong, F.	25, 122
Dono, G.	92
Drogoudi, P.	19, 79

E

Egitto, M.	144
Ellena, M.	125
Er, Ş.H.	155
Erdogan, V.	36, 52

F

Fabi, A.	68, 145
Fabrizio, G.	134
Facciotto, G.	138
Fanigliulo, R.	140
Fardelli, A.	173
Farinelli, D.	77, 164, 166
Fernandez, M.M.	61, 146, 152
Ferramondo, S.	165
Ferreira, H.	42
Ferreira, J.J.	108
Fideghelli, C.	16
Fogliano, V.	75
Forniti, R.	173
Franco, S.	91, 179, 180
Frattarelli, A.	115
Fuentes, R.	172

G

Gaiotti, G.	110
Gallelli, A.	30
Gantner, M.	63, 157
García, C.	108
Garino, C.	168
Gerbi, V.	170
Ghini, P.	49
Ghirardello, D.	170, 171
Giacalone, G.	126
Gilchrist, K.	24, 38
Giordano, M.	167
Goffreda, J.C.	23
Goginava, L.	123
Gogitidze, V.	123
Gološin, B.	118, 119
Gonçalves, B.	42, 158
Grau, P.	44
Griseri, G.	126
Grosso, S.	173
Guerrieri, M.	56, 83, 142, 159
Guidone, L.	59

Gutter, L.	61
Günay, K.	161
Gurcan, K.	28, 107

H

Hermoso, J.Fco.	26
Huang, W.	98, 99
Hummer, K.	27

I

Imani, A.	82, 163
Islam, A.	136
Isocrono, D.	124

J

Jaćimović, G.	118
Jil, P.	80
Julian, J.	86, 178

K

Karaman, S.	94
Kosenko, I.S.	116
Kron Morelli, R.o	154
Kurjakov, A.	118
Kurt, H.	136
Kuzmanović, Lj.	29, 104

L

Leotta, G.	130
Liang, L.	25, 122
Liang, W.	25, 122
Locatelli, M.	169
Lolletti, D.	43, 103, 127
Loru, L.	62
Lovisolio, C.	41
Lucchesi, B.	115
Lukić, M.	162
Lumia, V.	30
Lv, Y.	122

M

Magro, P.	66, 143, 144
Malvicini, G.L.	47, 128, 129, 175
Manquian, N.	172
Mansilla, R.	80
Manzi, L.	177
Marcucci, E.	143, 144
Marino, A.	47
Marongiu, S.	179
Marras, P.M.	62
Martelli, A.	167, 169
Martí, E.	78
Martins, S.	105
Marucchini, C.	166
Massantini, R.	159
McCluskey, R.L.	22

Me, G.	41, 59, 110, 124
Medel, F.	39, 80, 172
Medel, G.	39, 80, 172
Mehlenbacher, S.	15, 22, 28, 31, 107, 113
Mencarelli, F.	76, 173
Mencet, M. N.	94
Menesatti, P.	43, 174
Metzidakis, I.	19, 79
Mikadze, N.	123
Miletić, R.	120, 121, 162
Mirotadze, N.	123
Mitiouchkina, T.	35
Mitrović, M.	120, 121, 162
Molinari, F.	150
Molnar, T.J.	23
Monarca, D.	56, 83, 141, 142, 159
Moraglio, S.	59, 126, 147
Mordacchini, M.L.	83, 141, 159
Moutinho-Pereira, J.	42
Mozzone, G.	48, 129
Muleo, R.	69

N

Nardi, P.	133, 134
Nebykov, M.V.	116
Niciarelli, I.	174
Nicolosi, E.	130
Ninić-Todorović, J.	118, 119
Núñez, R.	172

O

Ocal, H.	71
Ognjanov, V.	118, 119
Okoń, S.	157
Olsen, J.	55, 64, 86, 178
Opalko, A.I.	116
Özenç, N.	51, 53, 131, 135
Özertan, G.	182
Ozman-Sullivan, S.K.	71, 153

P

Pagano, M.	137, 139
Paglia, G.	43, 174
Paliotti, P.	173
Pallottino, F.	174
Palma, H.	80, 172
Pancino, B.	91, 180
Pantaleoni, R.A.	62
Papachatzis, A.	112
Paparatti, B.	148, 149
Pereira, A.M.N.	158
Perry, J.	81
Petriccione, M.	111
Piccirillo, P.	111
Pilotti, M.	30
Ponso, A.	41
Postman, J.	27

Proietti-Zolla, C.	69
Prosperini, S.	170

R

Ragni, A.	154
Raiti, G.	130
Rakićević, M.	120
Raparelli, E.	103
Rimatori, V.	43
Rolle, L.	126, 171
Romero, A.	26, 78
Roversi, A.	47, 48, 128, 129, 175
Rovira, M.	19, 26, 79, 102, 108
Rugini, E.	29, 49, 104, 114, 117
Ružić, Đ.	121

S

Saghaian, S.	182
Sandoval, P.	44
Sanna, M.	126
Santi, M.	56, 83, 142
Santori, A.	67
Santos, A.A.	42, 105
Sarraquigne, J.P.	60, 61, 79, 146, 152
Saruhan, İ.	65, 151
Sathuvalli, V.	31, 113
Sayin, C.	94
Sborchia, D.	66
Scursatone, B.	170
Seavert, C.	86, 178
Sezer, A.	27
Silva, A.P.	19, 42, 79, 105, 158
Sivakumar, L.G.	176
Smith, D.C.	22, 31
Smith, F.	54
Solar, A.	19, 79, 109
Sona, H.	82, 163
Sonnati, C.	128, 138, 150, 175
Spanna, F.	126
Spaulding, A.D.	182
Spera, D.	19
Spera, M.	97
Speranza, S.	148, 149
Štampar, F.	109
Stévigny, C.	169
Sullivan, G.T.	71, 153

T

Tarasenko, G.A.	116
Tavella, L.	59, 126, 147
Timperio, A.M.	66
Tizzani, L.	30
Tomasone, R.	137, 139, 140
Tombesi, A.	77, 164, 166
Torello Marinoni, D.	40
Tous, J.	26, 78, 108
Travaglia, F.	75, 167, 168, 169

Tulum, Ö.	87, 182
Tuncer, C.	65, 151, 156
Turan, A.	21, 136
Turcu, E.	106, 112

U

Ughini, V.	128, 138, 150, 175
Uzunok, S.	70, 155

V

Valentini, F.B.	50
Valentini, M.	76
Valentini, N.	41, 59, 110, 124
Valle, W.	126
Varvaro, L.	68, 69, 145
Vicol, A.	106, 112
Vinotti, V.o	154
Vittori, D.	114

W

Walton, V.M.	64
Wang, G.	25, 122

X

Xie, M.	100, 101
---------	----------

Y

Yarılgaç, T.	132
--------------	-----

Z

Zadra, C.	166
Zeppa, G.	126, 167, 170, 171
Zeynalov, O.	35
Zheng, J.	100, 101