

FIELD AND CONTROLLED TEMPERATURE STUDIES ON THE FLOWERING OF HAZELNUTS IN AUSTRALIA

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Keywords, Pollen shed, bloom, hazelnut genotypes, temperatures

Abstract

Observations on the date of commencement and the period of pollen shed and female bloom were recorded for a range of hazelnut genotypes at five field sites over an eight year period. Date of commencement of both pollen shed and female bloom varied between seasons and sites but the order of pollen shed or female bloom showed very little variation. The earlier the genotypes came into pollen shed, the longer the period that pollen was shed. All genotypes were protandrous.

Three studies were undertaken using temperature controlled cabinets. Material from a range of genotypes was cut weekly and placed in cabinets where temperatures were maintained at 5°C, 10°C and 15°C. Pollen shed was observed to occur in the cabinets up to six weeks earlier than it occurred for the same genotype in the field but female bloom did not occur any earlier in the cabinets than in the field.

It is hypothesised there are two physiological processes affecting catkin extension; chilling which causes a decline in a plant regulating substance preventing catkin extension and warmth causing the production of a substance which stimulates catkin extension. Once the balance tilts in favour of the stimulating substance, catkin extension occurs. In the female flower, the principle factor is considered to be a decline in the retarding substance due to chilling. Once this is at sufficiently low levels, flowering occurs.

There is concern that with global warming, pollen shed will occur earlier, relative to female bloom resulting in poor pollination for later blooming varieties.

EFFECT OF FULL FLOWERING CLIMATE ON CROP YIELD
OF *GEVUINA AVELLANA* MOL.

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Keywords: *Gevuina avellana*, flowering climate, crop yield.

Abstract

Gevuina avellana Mol. is a native tree from Chile characterized by a high interannual variability in nut yield. The effect of climate during the full flowering period (FFP, February), in respect to the annual fruit yield variability, was studied from 1999 to 2008 in several clonal selections. Clone average yield was 23.5 ± 8.2 kg per year, and annual yield variability was significantly and highly correlated with medium temperature, accumulated precipitation and wind speed. As *Gevuina* is a self-infertile species which needs cross pollination made mainly by bees to form fruits, the climate during the FFP is likely to have firstly an effect over the intensity of pollination and therefore over the following yield. Thus, despite a presumably compensation between the crop load and nut weight, there is an overall effect from FFP climate on final NIS yield. This in turn broadly defines the total kernel and oil yield, being the last a main commercial objective due to its nutritional and phytotherapy properties. The climate during the FFP can exert a great influence on annual nut yield variability. These results are important in understand the productive behavior of *Gevuina*, and useful for its use as selection criteria for the *Gevuina* improvement program and for an adequate orchard management.

GENE EXPRESSION AND SPOROPHYTIC SELF-INCOMPATIBILITY IN HAZELNUT

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The European hazelnut (*Corylus avellana* L.) is a monoecious tree and exhibits sporophytic self-incompatibility. Self-incompatibility is a genetic system that prevents the self-fertilization allowing the pistil to throw back the pollen of genetically close individuals. Self-incompatibility is controlled by a single multi-allelic locus, the S locus.

Sporophytic self-incompatibility (SSI) has been reported in: Asteraceae, Betulaceae, Brassicaceae, Caryophyllaceae, Convolvulaceae and Sterculiaceae. The involved molecular mechanisms are still partly unknown, with the exception of the Brassicaceae. Studies on gene regulation of fertility, pollination and fertilization in hazelnut are very few; therefore, with this research we aim to contribute to the knowledge about the mechanism of sporophytic self-incompatibility in hazelnut.

In a first stage, the studies on Brassicaceae were used as a possible model to understand the self-incompatibility system in this species. The results obtained point out that the known sequences of *Brassica* cannot effectively be used for finding the responsible factors of self-incompatibility in hazelnut, but it doesn't exclude that the two mechanisms work in similar way.

Therefore, the Differential Display technique was applied for the study of the female determinant of self-incompatibility. Two developmental stages of female flower buds were compared: before styles emergence and full bloom. The results allowed to isolate partial sequences that showed an interesting homology degree with transmembrane serine-threonine kinase receptor of *Brassica oleracea*. Believing that the female determinant of self-incompatibility in hazelnut is very likely a membrane receptor, the efforts to get differentially-expressed sequences of this type were increased. Primers were designed on conserved regions of serine-threonine kinase receptors. Four differentially expressed fragments were isolated from stigmas at full bloom: after blasting in TIGR and NCBI databases, 1 was homologous with a gene for a kinase receptor, 3 were homologous to kinase proteins. The isolated sequences are being studied to check their expression in different style developmental stages and tissues.

PHYSIOLOGICAL ASPECTS OF HAZELNUT TREES GROWN
IN DIFFERENT TRAINING SYSTEMS

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Keywords: comparison between training systems, light penetration into the canopy, influence on fertility and yield, cryostabilization method

Abstract

A three-year (2004-2006) study to evaluate some physiological aspects of hazelnut trees grown in different training systems was performed in a orchard of 'Tonda Gentile delle Langhe' cultivar located in Cravanzana (CN) in a hilly area of the Piemonte region (North-Western Italy). Two training systems, free vase (monocauline form) and bush with three stems, were compared. Sunlight intensity through the canopy was measured using a portable solar bar. Measurements were taken on four replicate plants for each training system, inserting the bar at two heights above the soil and orienting it towards the cardinal points in the central hours of the day in mid June and mid July. Fertility, yield and fruit quality were determined on four branches, of the same plants, oriented towards the cardinal points in order to evaluate the influence of light penetration. In addition, a sample of leaves was collected from both shoots situated in a sunny and a shaded part of the canopy which was South oriented. Samples were submitted to the 'cryostabilization' method and the following parameters were determined on slices obtained with glass blades: leaf lamina thickness, palisade tissue percentage on total lamina, layers of palisade tissue and stomata density. The two training systems observed showed a different model of light penetration into the canopy, although no significant differences were found in fertility and yield. The mean thickness of the leaves in the sunny part of the canopy was 129.6 μm (48.9% of palisade tissue, with an average of 2.5 cell layers), while the mean thickness of the leaves in the shaded part of the canopy was 70 μm (28.7% of palisade tissue, with an average of 1.0 cell layer). Stomata density was 224.9 no/mm² for sunny leaves and 115.7 no/mm² for shaded leaves.

EFFECT OF TRAINING SYSTEM ON HAZELNUT
(*CORYLUS AVELLANA* L.) PHYSIOLOGY

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Keywords: carbohydrates, hazelnut, leaf anatomy, leaf gas exchange, phenols, photosynthetic pigments, training systems, water relations.

Abstract

Orchard management practices to optimize the fruit set, development and yield can be improved by the knowledge of the physiological parameters of the plants. In 2007, variations in leaf anatomy, chemical composition, gas exchange and water relations were studied in *Corylus avellana* L. cultivars Butler and Segorbe, grown freely as multi-stemmed shrubs and as a free single trunk (free vase). The trial was started in 1980 with several commercial hazelnut cultivars in Northern Portugal, at 470 m above sea level. The leaf traits analysed included leaf mass per unit area (LMA), density, area, relative water content (RWC), succulence, photosynthetic pigments, carbohydrates and total phenols concentrations. Other traits described the anatomy of leaves, namely the thickness of palisade and spongy parenchymata and epidermis. Net CO₂ assimilation rate, stomatal conductance, intercellular CO₂ concentration, transpiration rate, intrinsic water use efficiency and leaf water potential were also determined. Cultivar (cv.) Segorbe grown on a single trunk and cv. Butler grown freely had leaves with higher photosynthetic pigments concentration and LMA. Higher LMA was associated with higher leaf density and palisade parenchyma thickness. Trees grown on a single trunk had higher RWC than trees grown freely. Soluble sugars, starch and total phenols concentrations were not significantly affected by treatments. In addition, there were not significantly differences on leaf gas exchange and water relation parameters among cultivars or training systems, except for the trees grown on a single trunk that had higher transpiration rate. From a horticultural point of view, it seems that cv. Butler will benefit if grown freely and cv. Segorbe on single trunk.

HAZELNUT CULTIVAR IDENTIFICATION WITH LEAVE MORPHOMETRIC ANALYSIS: PRELIMINARY RESULTS

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Keywords: hazelnut, shape, geometric morphometric, cultivar identification, CVA

Abstract

The variety identification in hazelnut is an important aspect in the nursery and in the orchard. Methods based on molecular biology are expensive, complex and often ineffective due to the presence of hybrids. Plant taxonomists recognized the importance of leaf features for identifying taxa a long time ago. In this work, authors evaluate the possibility to apply a more rapid and simple, and sometimes more effective, method based on the morphometric analysis of digital leaf images.

In this preliminary work, a comparison of leaf morphology for evaluating differences between three cultivars was conducted through the geometric morphometric analysis. Twenty-four leaves collected from trees of the field station in Fiorano-Rome for three commercial cultivars (Batler, Ennis, Tonda Gentile Romana) of hazelnut (*Corylus avellana*, L. 1753) were analyzed via geometric morphometric tools, after their image scanning (300 d.p.i.; 24 bit color). This method allows the visualization and the quantification of morphological differences by representing the deformations of morphometric points (landmarks) in a coordinate space. Landmarks are defined as homologous points bearing information on the geometry of biological forms. Twenty-eight points along the margins and at the basis of the veins on the inferior side of each leaf's scanned image were digitized using the software TpsDig. A Canonical Variates Analysis (CVA) was performed on the obtained weight matrix (W') in order to discriminate among cultivars. The three cultivars were discriminated with an efficiency of 100%. Further trials on many more samplings and cultivars will be useful to test, implement and give more reliable results. The preliminary results obtained indicated a technical feasibility of the proposed method.

XYLEMATIC POTENTIAL AND STOMATAL DENSITY IN THREE CULTIVARS OF HAZELNUT (*CORYLUS AVELLANA* L.) IN THE REGION DEL BIO BIO, CHILE

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Keywords: hazelnut production, environmental stress, xylematic potential, stomatal density

Abstract

The hazelnut growing area and production has been increasing dramatically in Chile since 1995, reaching more than 5.000 ha. Potential growers are permanently asking about cultivar performance in their local conditions in order to take decisions about the cultivar to choose for their needs. In research trials and commercial orchards, a dramatic difference between cultivars performance in relation to adaptation and yield potential was observed. In the case of Barcelona and Tonda di Giffoni, both cultivars show a very good potential, compared to Tonda Gentile delle Langhe, which shows also a low vigor. The climatic conditions of some areas of production may trigger the occurrence of a very high vapor pressure deficit in the plant, due to hot winds and/or low relative humidity in the environment during the growing season. Some species such as *Corylus avellana* are very sensitive to such conditions, as they require between 70 and 80% of relative humidity during the growing season. With the purpose to determine if some physiological traits of the plant, such as xylematic potential and/or stomatal density, allow to explain such a behavior, a trial comparing those three cultivars was carried out. The study was completed between January and March 2007 in the Region del Bio Bio, Chillan. The measurements were performed every ten days, at 6:00 (predawn), 10:00, 2:00 and 4:00 pm. At 6:00, the values of xylematic potential varied between -0.05 and 0.25 Mpa. At 10:00, the values varied between -0.2 and 0.5 Mpa. At 14:00, the values were between -0.4 and -0.8 Mpa; and at 18:00, the values varied between -0.3 and -0.8 Mpa. There was not any difference between the three cultivars at any time of the day and during the study.

Stomatal density was 42.7; 46.6 and 39.5 stoma/mm² in Barcelona, Tonda di Giffoni and Tonda Gentile delle Langhe, respectively; however, the difference was not significant between them. This result does not allow to explain the difference in behavior between the cultivars in terms of xylematic potential or stomatal density.

ORAL SESSION N.3

Orchard Management



Chairman: *Cristina Bignami*

ON THE QUALITY OF HAZELNUT PLANTS OBTAINED BY MOUNDING LAYER

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Keywords: coppice, mother plant, propagation, suckers forcing.

Abstract

In Italy, unfortunately, the material for the plantation of new hazelnut orchards is often obtained taking out the rooted suckers from the plant in the orchard. Of course, this primitive propagation method presents serious genetic and phytopathological problems. However, in the last 15 years, in the Langhe (Piemonte), a few nurseryman used to apply the mounding layer with acceptable results. With the aim to increase these results, some treatments were investigated on mounding layer to a 2-year-old mother plant (Tonda Gentile delle Langhe). The experimental design concerned the use of Agriperlite® as rooting medium instead of soil for mounding. In the other 2 thesis, the water- safe (Hydroretenteur®) polymer and a commercial mycorrhiza product were added and blended to the mounding soil. Immediately after the ringing, rooting hormone (IBAK, at 3000 ppm) was sprayed at the sucker bases near the ringed point. Each thesis were applied to 6 replicates of 50 mother plants each one. At digging time, the rooting percentage, the rooted suckers and the marketable classification were recorded. A remarkable increase in root mass weight was obtained by the addition of mycorrhiza and Hydroretenteur® to mounding soil. The rooting percentage was significantly increased by mycorrhiza and Agriperlite®. The first class rooted suckers and the marketable percentage were significantly increased by mycorrhiza and Hydroretenteur® . The increasing of rooting percentage due to IBAK don't need explications, the positive effects of Hydroretenteur® could be due to its capacity to maintain a good humidity level in the soil during rooting, whilst the positive effect of mycorrhiza seems to need further investigations.

FURTHER INVESTIGATION ON HAZELNUT MOUNDING LAYER

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Keywords: coppice, propagation, rhizogenesis.

Abstract

For 2 years (2005-2006) in a commercial hazelnut orchard of Tonda Gentile delle Langhe, plants which were too old and with unsatisfactory production were cut at the base and the coppice obtained was used as mother plant for mounding layer. In both years, some months after the cutting, that is June – July, the suckers were ringed to force their basal rooting. The effects of IBAK (Indol-butyric acid, Potassium salt at 300 ppm), applied to the suckers and immediately after their ringing on rooting and on plant quality, were studied. The addition of water-safe polymer (hydroretenteur) to the mounding soil was also investigated. At ringing time the suckers vigour, was evaluated by their number obtained by coppice, and height were recorded. At digging time, the rooting percentage and marketable classification of rooted suckers were evaluated.

A high coppice vigour seems to be needed to obtain a high percentage of first class rooted suckers.

Also, the application at the ringing time of IBAK and the addition of the water-safe to the mounding soil significantly increased the number/coppice of marketable rooted suckers.

EFFECTS OF IRRIGATION ON GROWTH AND YIELD COMPONENTS
OF HAZELNUT (*CORYLUS AVELLANA* L.) IN CENTRAL ITALY

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Keywords: drip irrigation, irrigation level, leaf assimilation rate, technological traits, productivity

Abstract

Hazelnut is sensitive to water stress. Because of low water availability and irregular rain yearly distribution, drought conditions are becoming common in the regions of Central Italy, such as Latium, which is the second area of hazelnut production in Italy. Drip irrigation based on water balance is then an appropriate technique to improve production and growth, optimising water use. An experiment was thus set up in 1992 in Viterbo (Central Italy) to study the long term response of vegetative growth and production to irrigation of hazelnut, cvs. Tonda Gentile Romana, Tonda di Giffoni and Nocchione. Four treatments were applied by means of drip irrigation since the second year from planting: an un-irrigated control and three water levels, corresponding to the restitution of 50, 75, 100 % ET_c calculated from class A of evaporation. The results of the adult stage of the orchard life are here reported. Yield, nut traits and defected nuts, oil content in the kernel, vegetative growth (shoot length, trunk cross-sectional area and canopy volume) and leaf assimilation rate were measured on fifteen/sixteen-year-old plants.

Vegetative growth and yield components were positively affected by irrigation. The highest plant yield was obtained at the 75 % ET_c for all cultivars and both years. Nut and kernel weight and size were slightly greater in irrigated than in control plants. The percentage of empty and defected nuts was higher in condition of limited water availability. The oil content in the kernel was slightly higher in 75 % and 100 % ET_c than in the other treatments for all cultivars. Leaf assimilation rates of Tonda Gentile Romana and Tonda di Giffoni showed the highest values in the early morning and low differences between treatments.

In conclusion, water supply of 75 % and 100 % ET_c could be valid irrigation levels for hazelnut cvs. Tonda Gentile Romana, Tonda di Giffoni and Nocchione in areas characterized by insufficient rainfalls during the year.

EFFECT OF DIFFERENT PRUNING INTENSITY ON GROWTH, YIELD AND QUALITY OF THE HAZELNUT CULTIVAR 'TONDA GENTILE ROMANA'

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Keywords: *Corylus avellana* L., light infiltration, trunk cross-sectional area, oil content

Abstract:

In Central Italy (Latium region), the pruning of mature hazelnut trees is usually done during the winter and it is generally limited to the removal of suckers, dead wood and old, diseased or broken branches. Reduction of shoot vigour, low light penetration within tree canopy and yield decline are long-term consequences observed in the main cultivar of this area: the medium-vigour Tonda Gentile Romana. Thus, an appropriate method of pruning for this cultivar is still lacking. In order to study the effect of two different pruning methods, respectively based on low (thesis A) and high (thesis B) intensity of pruning and renewal of the crown, three randomized plots per thesis (4 plants per plot) in an adult orchard of 'Tonda Gentile Romana', with three-stem plants spaced 5 x 5 m, were carried out and compared with an un-pruned thesis from 2004 to 2006. Weight of annual pruned wood, vegetative growth, light infiltration at the base of the plots, yield and nut traits, defects and kernel quality were measured, in order to quantify the plant response to a different intensity of pruning. The results indicate good productivity and vegetative growth in the thesis B at the end of the three year investigation, and yield per hectare slightly decreased only in the first year in comparison with thesis A. Light infiltration at the base of the plants was low in un-pruned plots, whereas thesis B was characterized by better light penetration. The intensity of pruning had only a slight effect on nut traits, but thesis A and B showed a lower incidence of defected nuts than the un-pruned control. On average, the oil content in the kernel was slightly higher in the nuts collected in thesis A, while very low differences were observed in the other chemical components, as soluble sugars and organic acids, starch and fatty acid composition.

DETERMINATION OF HAZELNUT HUSK DECOMPOSITION LEVEL
AND OF THE CONTENT OF SOME PLANT NUTRIENT ELEMENTS
UNDER NATURAL CONDITIONS

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Keywords: hazelnut husk, decomposition, plant nutrient elements

Abstract

Hazelnut husk, a harvest by-product, is a product of great agricultural interest. In addition, nobody has considered yet that this waste causes a problem for producers and enterprises. It was suggested that hazelnut husk would be turned into compost and used as organic fertilizer. However, usage of hazelnut husk compost has not become widespread yet.

This study was carried out to determine the decomposition level of hazelnut husk and the content of some plant nutrient elements which are present under natural conditions. In a 4-year laboratory study (2004-2007), we determined: decomposition level (C/N ratio), organic matter content, organic carbon %, pH, electrical conductivity (EC), cation exchange capacity (CEC), total nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) contents in hazelnut husk. Hazelnut husk kept under natural conditions during the second year had still high C/N ratio and was unfit for usage as organic material. Even if hazelnut husk did not fully decomposed during the third and fourth year, it was practicable in agriculture. Moreover, the content of nutrient elements in hazelnut husk decreased during the decomposition period, but these values did not fall under an acceptable limit to use it as organic material.

EFFECT OF FOLIAR BORON APPLICATION ON FRUIT SET
IN 'TOMBUL' HAZELNUT

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Keywords: boron, fruit set, 'Tombul'

Abstract

Fruit production in hazelnuts mainly depends on number of female flowers that set fruit. Thus, maximizing fruit set is important. The aim of this study was to determine if fruit set could be increased by foliar Boron (B) applications in 'Tombul' hazelnut. The experiment was conducted in a grower orchard near Persembe, Ordu, (Eastern Black Sea region) in Turkey. 300 ppm and 600 ppm B per ocak with 0.25% of nonionic wetting agent (Tween-20) were sprayed with hand gun sprayer in the third week of May. Control ocaks received water plus wetting agent. Leaf and soil analyses for macro and micro elements were performed. In both years of study, 300 ppm was more effective than 600 ppm on fruit set. In the first year, B applications increased fruit set by 28.6% in average. However, only 300 ppm B treatment resulted in increased fruit set (12.15%) in the second year. The results showed that the effect of B on fruit set varies from year to year.

ROLE OF TANNINS IN THE RESISTANCE TO MAJOR PESTS OF HAZELNUT CULTIVATED IN POLAND

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Keywords: *Corylus avellana* L., filbert aphid, filbert big bud mite

Abstract

The consequence of a hazel cultivation's wider area in Poland in recent years, and development of integrated methods for its protection, is of big interest for the cultivars which show the features of resistance to diseases and pests, apart from their productive values. In principle, the cultivars' resistance is extremely stable in the years, irrespective of the pest population number in the vegetation season. The purpose of the presented researches are to reveal the sources of resistance in cultivars of large-fruited hazelnut cultivated in Poland to two of the most dangerous pests, namely filbert big bud mite (*Phytoptus avellanae* Nal.) and filbert aphid (*Myzocallis coryli* Goetze). Four hazelnut cultivars showing significant differences from susceptible to moderate resistance to the both pests were tested in the outdoor and laboratory conditions. None of the tested hazelnut cultivars showed the total level of resistance to the both tested pests. 'White Filbert' cultivar showed partial resistance to *M. coryli*, while 'Hall's Giant' cultivar to *P. avellanae*; however, the partial and complex resistance to both pest was found in 'Luizen Zellernuss' cultivar. The highest susceptibility to filbert big bud mite and filbert aphid was found in 'Minnas' cultivar. The presented results show that the content of secondary metabolites, mainly tannins, was the most important source of constitutive resistance of the large-fruited hazelnut to the filbert big bud mite and to the filbert aphid. Other traits determining the lack of acceptance during the initial selection of host plants differ in individual hazelnut cultivars and they might be overcome by pests during plant settlement. Cultivation of hazelnut cultivars with increased resistance to both pests would be able to contribute the reduction of their population number. Consequently, it would decrease using insecticides, as well as the costs of hazel cultivation in our country.

THE CURRENT STATUS OF THE NEWLY INVASIVE HAZELNUT APHID IN OREGON HAZELNUT ORCHARDS

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Key words: hazelnut aphid, *Corylobium avellanae*, hazelnut, pest management

Abstract:

Hazelnuts are produced in many countries, including the United States. Here hazelnuts are grown on approximately 15,000 hectares in the Willamette Valley, Oregon. This production area accounts for roughly 99 percent of U.S. production and 5 percent of world production. Current key insect pests in this area include filbertworm, *Cydia latiferreana*; filbert aphid, *Myzocallis coryli*; hazelnut aphid, *Corylobium avellanae*; filbert leafroller, *Archips rosanus*; and obliquebanded leafroller (OBLR, *Choristoneura rosaceana*). Of these, filbertworm and filbert aphid are perceived to be the most important. Before the mid 1980s, the filbert aphid was considered the only important aphid pest of hazelnuts in Oregon. The hazelnut aphid, a newly invasive species, was however first reported by the Oregon Invasive Species Council in October 2003 on hazelnut trees in the northern Willamette Valley in Oregon. Recent collections of this aphid from various orchards and wild habitats show that this pest has spread rapidly into many hazelnut production areas. This species however currently comprise a small proportion of the total aphid population in Oregon orchards. Preliminary data from field work during 2007 show that this species currently have low levels of parasitism compared to filbert aphid. Data show that this species prefer husks to feed on. In severe cases this feeding preference may negatively impact crop levels due to husks drying out prematurely. Levels of hazelnut aphid are therefore cautiously monitored in order to determine changes in species composition. Alternative IPM strategies in order to conserve biological control are discussed.

CHEMICAL CONTROL OF TRUE BUGS (HETEROPTERA: PENTATOMIDAE,
ACANTHOSOMATIDAE AND COREIDAE) TO PREVENT KERNEL DAMAGE
IN HAZELNUT ORCHARDS OF TURKEY

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Keywords: hazelnut, chemical control, Turkey, true bugs, kernel damage

Abstract

Insect pests cause substantial damage in hazelnut orchards. Some insect species of the Pentatomidae, Acanthosomatidae and Coreidae family feed on hazelnut kernels and cause quantity and quality problems. More than 15 insect species causing the aforementioned damage have been determined in Turkish hazelnut orchards until today. Among these insect species, Green shield bug (*Palomena prasina* L. Het.: Pentatomidae) has the highest density in Turkish hazelnut orchards. The main damage on nuts caused by these insects occurs mainly after the nut formation from June to the end of August. In general, there are no control measurements against these pests in Turkey in spite of obvious need.

In this study, the effect of chemical control applied for these insects on nut peculiarities was investigated in 2003. The study was conducted in the three Turkish provinces of Sakarya, Kocaeli and Düzce. Ten hazelnut orchards were selected and sprayed during the growing season. Five orchards were sprayed once and other five orchards twice. First sprays were carried out in 28-30 June, 2003 and second sprays were in 19-20 July, 2003. Half of each orchard was sprayed with insecticide and the other half was sprayed with water as control. Carbosulfan (Marshall 25 EC) was used as chemical in all experiments.

In harvest time, nuts from each orchard were collected and examined in laboratory after shelling in order to determine insect damage. Nuts were classified as empty, healthy and damaged.

As a result of the experiments, it was found that plots sprayed once and control plots showed minor differences in the nut damage caused by insects. When developed kernels were considered, damaged kernel ratio varied between 3.16-11.81% in plots sprayed once, and 4.21-21.65% in control plots. Spraying twice gave better results in preventing kernel damage. In all the experiments in which the spraying occurred twice, kernel damage decreased significantly in sprayed plots. Damaged kernel ratio varied between 1.08-4.45% in sprayed plots and 3.86-11.68% in control plots.

COSTITUTIVE AND INDUCED RESISTANCE IN HAZELNUT CULTIVARS

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Keywords: hazelnut cankers, induced resistance, acibenzolar-S-methyl, β -aminobutyric acid, potassium monophosphate

Abstract

The chemical inducers acibenzolar-S-methyl (BTH), β -aminobutyric acid (BABA) and potassium monophosphate (KH_2PO_4) were tested for their capacity to control hazelnut cankers caused by *Cytospora corylicola*, *Botryosphaeria obtusa* and *Biscogniauxia mediterranea*. Chemicals were applied twice by foliar spray (BTH and KH_2PO_4) or soil drench (BABA) on hazelnut plants, cultivars Tonda Gentile Romana and Nocchione, which represent the most common ones in the district of Viterbo (Central Italy). Treated plants were assayed for the induction in their tissues of pathogenesis related (PR) proteins β -1.3 glucanase, chitinase and peroxidase, as biochemical indicators of resistance. Beside the presence of constitutive isoenzymatic forms, the results show that the chemical inducers activated the differential induction of particular *de novo* synthesised isoenzymes of these proteins. Two dimensional electrophoresis were applied to demonstrate differences between protein species. Moreover, novel protein species previously reported from plant-pathogens interactions and some species with unknown homologues were reported and identified by using mass spectrometry. Hazelnut plants treated with the three chemical inducers of resistance were inoculated with the three pathogens and disease development and severity was evaluated.

GRAY NECROSIS OF HAZELNUT FRUIT:
A FUNGAL DISEASE CAUSING FRUIT DROP

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Keywords: *Fusarium*, hazelnut diseases, *Alternaria*, fungi, fruit drop, nut diseases

Abstract

In the early summer of 2000, a severe fruit drop was observed in several hazelnut (*Corylus avellana*) orchards located near Viterbo (Latium, Italy), resulting in a high yield loss. Dropped fruits showed a brown-greyish spot at the base of the nut which progressed into the fruit with discoloration of the pericarp and embryo tissues, often involving bracts and petiole. The severity of the fruit drop and the unusual type of symptoms suggested a thorough research to understand the etiology and epidemiology of the disease named gray necrosis (GN) on the basis of the symptomatology. The symptoms of GN differed from all other currently reported diseases of the hazelnut fruit. Investigations based on isolation from flowers and fruits, and artificial inoculations led to a definition of the first picture of the causal agents of the disease. *Fusarium lateritium* was the most frequently isolated from both fruit and cankers on twigs, and its occurrence is closely related to GN. Pathogenicity tests confirmed *F. lateritium* as the causal agent of "L" shaped cankers on twigs and shoots. Artificial inoculations with *F. lateritium* evidenced its role as primary agent of the GN disease. In addition, artificial inoculations confirmed the pathogenic attitude of small-spored catenulate *Alternaria* taxa related to *A. alternata* (*A. alternata*, *A. arborescens*, *A. tenuissima*). The role and timing of the different fungi in causing GN will be investigated.

APPLICATION OF GEOSTATISTICS IN STUDYING EPIDEMIOLOGY
OF HAZELNUT DISEASES: A CASE STUDY

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Keywords: dieback, GIS, geostatistics, Kriging, hazelnut diseases, climatic conditions

Abstract

New information management technologies, such as geographic information techniques (GIS) and geostatistics, have been already applied in the past in the study of spatially related data in plant pathology. In particular, geostatistics offer a mean to describe spatial continuity, an essential feature of many natural phenomena, such as the spreading of a plant disease. Various hazelnut diseases and their epidemiology are susceptible to be investigated by means of these technologies. "Kriging" is a regression technique used for the estimation or interpolation of spatially located and spatially correlated data. This work shows an example of the Kriging method applied to the study of the epidemiology of the Dieback hazelnut on Monti Cimini (Central Italy), in relation to climatic factors occurred in 6 years of observation. This method, properly adapted, is susceptible to be also applied to the study of other hazelnut diseases and even to several spatial phenomena interesting the culture. The hazelnut Dieback is a bacterial disease which has been affecting hazelnut orchards in Province of Viterbo since the 1980s. In the last years, many aspects were clarified but, on the other hand, other questions still remain unsolved about the epidemiology, such as the particular incidence of the disease on areas characterised by specific climatic features. The Kriging geostatistic method was applied in order to better explain the role of the temperature and of the rainfall on the progression of the disease in the last years. A major concentration of diseased and dead plants was observed in two peculiar areas of hazelnut cultivation: the first one on the outer part of the volcanic caldera of Lake of Vico, and the second one on the northern inner part of the caldera itself. The disease spread mainly in areas which were still interested by the hazelnut dieback since its first appearance. The results of the semivariogram parameters show a good spatial autocorrelation, especially in the period 1998-2000 and for the year 2003. Also, a high significance statistical correlation between the incidence of the disease and lower winter temperature, late frost injury or average rainfall, was found. Probably the hazelnut dieback can be described as a disease of complex aetiology.

TRIBOSOMAL AND AFLP ANALYSES ARE TOOLS FOR ENRICHING
THE KNOWLEDGE OF HAZELNUT DIEBACK

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Keywords: AFLP, bacterial disease, *Corylus avellana* L., molecular marker

Abstract

Dieback of hazelnut is a bacterial disease that determines the decline of hazelnut (*Corylus avellana* L.) both in Northern Greece and Central Italy. Disease symptoms include the rapid wilting of branches and trees, which can be observed from spring to autumn. In this work, AFLP analysis has been used with the aim to discriminate among different bacterial strains picked up from plant material clearly showing the symptoms of dieback. The infected hazelnut plants were located in areas of Latium region, which are typically vocated for the cultivation of hazelnut. AFLP-polymorphic fragments have been isolated, sequenced and analysed *in silico* to identify possible functions. Specific primers have been designed to transform the polymorphic fragments in SCAR. SCAR and ribosomal analyses have been conducted on the bacterial strains to link them to their area of diffusion.

DISEASES IN IPM HAZELNUT ORCHARDS
OF THE WEST BLACKSEA REGION IN TURKEY

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Keywords: virus, fungus, noninfectious, hazelnut

Abstract

Cultivation of hazelnut (*Corylus avellana* L.) is one of the considerable economic crop in Turkey, in particular, in the Blacksea Region. Hazelnut diseases are the other major detriment to hazelnut cultivation following insect pests in Turkish hazelnut orchards. Damage estimation varies from 20 to 50% depending on the cultural practices, treatment efficacy and environmental conditions. Although 33 diseases were reported on hazelnut as economic significant diseases up to now, a few of them were found to be economic significant in IPM orchards of the west Blacksea region in studies conducted in 1997-2005. A lot of disease symptoms were observed and six of them were found to have economic significance. Symptoms of *Apple mosaic ilarvirus*, powdery mildew, Nectria canker, Armillaria root disease and nutrient deficiency were observed in IPM orchards. The *Apple mosaic ilarvirus* symptom was determined in almost all IPM orchards.

INSECT PESTS OF STORED HAZELNUTS IN THE SAMSUN PROVINCE, TURKEY

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Keywords: hazelnut, processing plants, storage pests, Turkey

Abstract

Turkey is by far the world's leading producer and exporter of hazelnuts. They are processed at processing plants and stored in warehouses prior to distribution and export. Hazelnuts are vulnerable to infestations by insects which are the main pest group affecting the quality and quantity of stored products. This study determined the insect species and their population densities in stored hazelnuts during the summer of 2007 in the Samsun province of the Black Sea region of Turkey. Sub-samples of shelled, in-shell and cracked hazelnuts were randomly collected and mixed at each plant. A 1 kg hazelnut sample was then taken from each plant and stored at 25 °C and 60±5% in the laboratory. The samples were checked every two weeks and insects were identified and counted. Insects were found in all facilities. They were *Plodia interpunctella* (Hübner), *Ephestia cautella* (Walker), *Tribolium confusum* (Jacquelin du Val), *Tribolium castaneum* (Herbst) and *Oryzaephilus mercator* (Fauvel). *Plodia interpunctella* and *E. cautella* were the most common, and *Tribolium confusum* was more common than *T. castaneum*. All 4 species had maximum populations in July. *Oryzaephilus mercator*, which was the rarest, had maximum population in early September. In conclusion, insects are a potential problem in stored hazelnuts. Their number and damage should be closely monitored and treatments applied when appropriate.

ORAL SESSION N.5

Post Harvest, Quality and Industry



Chairman: *Joan Tous*

MOLECULAR MARKERS TO EVALUATE QUALITY AND SAFETY
OF ROASTED HAZELNUTS: AN OVERVIEW

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Keywords: hazelnut roasting, quality and safety, D-amino acids, acrylamide, HMF

Abstract

The roasting process contributes to the developing of Maillard-related compounds and to the consequent aroma development. Time, temperature, moisture and type of process influence the impact on the seed. Some toxic compounds were produced *de novo* during roasting. For example, the carcinogenic acrylamide (a Maillard-related compound, resulting from the reaction of asparagine with reducing sugars) and racemized D-amino acids can accumulate in roasted nuts. Acrylamide is probably carcinogenic to humans (IARC, Group 2A); the toxicity of D-amino acids is still under investigation.

In our study, Acrylamide and D-amino acids were evaluated i) in some industrial samples of TGL cv, roasted using different methods/plants and ii) in seeds roasted in conventional ovens in different conditions.

Acrylamide was recovered in all roasted samples (up to 200 µg/Kg). Acrylamide concentration during roasting showed a characteristic bell-shape profile. A significant impact was highlighted; concerning both protein-bound (i.e. D-Asp: 1,49% ± 0,08) and free D-amino acids (D-ala: 5,87% ± 0,03). D-amino acids showed a linear increase, proportional to the temperature. Other conventional markers (5-hydroxymethyl-2-furaldehyde, peroxides) useful to assess the quality of hazelnut were also considered.

This research will highlight the crucial parameters useful to obtain a "safe" roasting process confirming the need of a process optimization.

NONDESTRUCTIVE APPROACH TO MEASURE QUALITY OF HAZELNUTS DURING STORAGE

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Keywords: hazelnuts, storage, NIR-AOTF, MRI, electronic nose

Abstract

The aim of this work is directly related to the opportunity to apply non destructive technologies for quality determination on hazelnuts during their storage. Hazelnuts of different varieties were stored at different conditions and tested by non destructive techniques such as NIR- AOTF (portable instrument) and MRI (batch instrument). NIR analyses were performed with the intention to discriminate latent damage, oxidized hazelnuts, and fresh and stored hazelnuts. The instrument was able to efficiently discriminate the high quality hazelnuts from the stored ones or the hazelnuts with latent damage even directly from the spectra observation. MRI was used to discriminate Tonda Gentile Romana and Akakocha hazelnuts during the storage under nitrogen, carbon dioxide or air at low temperature. MRI was able to discriminate in term of t1 and t2 the different samples in accord with destructive analyses. MRI was able to discriminate fresh and stored dried hazelnuts. These hazelnuts were discriminated even by electronic nose. All these applications have provided interesting information about the potentiality of some non destructive applications in recognizing qualitative attributes of hazelnuts.

INFLUENCE OF PEDOCLIMATIC CONDITIONS AND ORCHARD MANAGEMENT
ON FRUIT QUALITY CHARACTERISTICS
IN CV.S TONDA GENTILE ROMANA AND TONDA GIFFONI

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Keywords: hazelnut, pedoclimatic conditions, quality, chemical composition

Abstract

Hazelnut represents a significant component of the fruit industry in the Lazio region of Italy, but it is struggling with competition on the international market. One approach to restore the competitive ability of the industry is improving quality assessment and developing strong local association of the product in the perception of the consumer.

It is therefore important to define and evaluate qualitative aspects of hazelnut cultivars such as Tonda Gentile Romana and Tonda di Giffoni related to pedological and climatic conditions, as well as orchard management practices in the typical areas of cultivation.

The following data were collected for both cultivars in five farms located in the Monti Cimini area (Viterbo), including: chemical and physical soil properties, leaf analysis, nut and seed size, percentage of kernel, blanching score, kernel flavor and texture, chemical composition.

Multiple years of observations showed that the combination of pedoclimatic conditions and orchard management practices clearly influences nut and seed traits; particularly, higher levels of organic matter and nitrogen in the volcanic soils of the considered orchards correspond to improved kernel/shell ratio and higher taste panel scores.

Chemical composition of kernels is also influenced by different cultivation areas, with significant differences in quality and quantity of amino acids, carbohydrates and aromatic compounds, which implies the potential for identifying product origin on a chemical basis.

WHITE SPOTS IN HAZELNUT KERNEL: SIMPTOMS, CAUSES AND QUALITY LOSS

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Keywords: green bugs, *Nezara viridula*, *Elamuscha betulae*, quality loss.

Abstract

White spots in the hazelnut kernel may involve up to 60% of total crop, depending on the geographical origin, climate of the year and cultivars. Affected kernels show one or more white zones of different extension that are soft, not wet nor deformed. Such damaged kernels become rancid at least twice faster than normal ones, and whitish spots become more evident after roasting and peeling the kernels, which implies lower prices in the industrial market.

In order to determine the origin of this affection, several studies were carried out since 2004 to 2006, until the real cause was established. These studies included hazelnut sampling at different ripening times, different cultivars, insect trapping, microscopic and macroscopic studies of affected kernels, and several preventive strategies for hazelnut trees.

Fruit sampling in different dates showed that the affection begins at the end of July (in Catalonia, Spain), when the kernel is fully developed and the shell is almost lignified. Microscopic studies revealed that insect biting are the cause of the white spots, while trapping and protective studies pointed out that the bugs *Nezara viridula* L. and maybe *Elamuscha betulae* are responsible for kernel white spots. Earlier, green bugs were considered to be responsible for kernel damaging and it was accepted that they bit hazelnuts only in the first steps of nut development, when the shell is not lignified yet, and they are responsible for black spots and large deformations in the affected kernels. No evidence has been reported relating green bugs with whitish spots appearing in the last stages of fruit development, when the shell is almost fully lignified.

Future studies will consider chemical spraying on hazelnut trees at different stages, with different products, in order to prevent green bug attacks to hazelnut kernels.

PHENOLIC CHARACTERIZATION OF SOME HAZELNUT CULTIVARS FROM DIFFERENT EUROPEAN GERMPLASM COLLECTIONS

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Keywords: *Corylus avellana* L., local germplasm, phenolic compounds, HPLC

Abstract

Sixty-one cultivars, principally the main national varieties or some endangered old cultivars from six countries (France, Greece, Italy, Portugal, Spain and Slovenia) were analysed for their phenolic composition in the frame of the European SAFENUT (Safeguard of hazelnut and almond genetic resources: from traditional uses to novel agroindustry opportunities) project.

Using a high-performance liquid chromatograph (HPLC) with a diode array (PDA) detector, the content of phenolic compounds was analyzed in extracts of the kernels. Gallic, chlorogenic, sinapic, p-coumaric, ferulic and ellagic acid, as well as epicatechin and rutin, were individually identified in all cultivars tested. A large variation in the phenolic content between cultivars was noted. Intercultivar variability was the most expressed in the sinapic, ellagic and p-coumaric acid, as well as in the rutin. The cultivar 'Casina' from France had the highest sum (251.01 mg/kg) of all the identified phenolics. On the contrary, the Greek cultivar 'Polycarpus' was the poorest in phenolic compounds et al. (49,16 mg/kg).

In the chromatograms, two interesting and distinctive peaks were expressed besides the compounds mentioned above. Using the listed standards, it was impossible to determine the compounds which belong to those two peaks. They were called a and b, and they were expressed as equivalents of the chlorogenic acid. 'a' and 'b' were the most abundant phenolics in all studied cultivars (mean value for a was 38.95 mg/kg, and for b was 39.74 mg/kg). With the aim of identifying them individually, an improved method, MS-HPLC, will be used next year.

Phenolic compounds have shown disease preventing and several health promoting effects. Nowadays, they have received great attention among researchers due to their antioxidant activity. The ellagic acid is one of the most important polyphenolic antioxidant. In our study, it appeared in concentrations between 0.56 mg/kg ('Polycarpus', Greece) and 18.55 mg/kg ('Porpurea', Portugal).

Considering the different content of polyphenolics, it can be concluded that the tested cultivars vary in their antioxidant capacity. Consequently, they vary also in their beneficial impact on human health. The antioxidant activity of the kernels in different cultivars will be determined in the following two years.

MONOUNSATURATED FATTY ACID ISOMERS OF
GEVUINA AVELLANA MOL.
 NUT OIL AND UV RADIATION FILTER

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Keywords: *Gevuina avellana* Mol., monounsaturated isomers, UV radiation filter

Abstract

The research programme for *Gevuina avellana* Mol. (Gevuin), a tree native from Chile, has developed genotypes with interesting results for phytotherapy and cosmetic purposes. The physical and chemical characteristics of nut oil has several uses as skin care, for restoring treatments (turgor, elasticity, healing) and as UV radiation natural filter. From 2003 to 2007, nut oil of selected clones obtained by cold extrusion was analyzed to determine the lipid composition and UV filter quality. HPLC and GC-MSD methods were used to determine the fatty acid content profile. UV blocker power from different samples was analyzed with a Milton Roy Array 3000 spectrophotometer. Principal monounsaturated fatty acids were: C_{16:1}, C_{18:1}, C_{20:1} and C_{22:1}, with several isomers and a wide range of variation among different genotypes. The maximum value of oil absorbance was in the range of 285 – 315 nm (UVB), with important values in the upper range of UVC (250 – 285 nm) and in the lowest of UVA (315 – 350 nm). This effect is in part due to the particular lipid structure of some monounsaturated fatty acid isomers. The effect of the positional double bond within the acyl chain ($\Delta:\omega$), molecular weight and carbon number, could explain the UV filter behaviour of Gevuin oil.

COUNTRY REPORT: THE EMERGING HAZELNUT INDUSTRY IN CHILE.
WILL IT BE SIGNIFICANT?

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Keywords: global market, Chile, hazelnut industry

Abstract

There is significant interest in the rapid development of the hazelnut industry in Chile. From the 2007 census, it is estimated that over 5,000 hectares of hazelnut orchards have now been planted in Chile with an additional 1000 hectares being added yearly. With the average age of the planted trees put at 2 years, these orchards will not be providing serious volume before another 5-7 years or so. This emerging industry faces significant challenges in production, infrastructure and marketing. At the production level, the predominant variety is called "Armengoli Barcelona" which appears to be large Barcelona-like nut but its actual type is unclear. There is a large variety of pollinizers being planted with significant uncertainty as to which varieties will prove optimal. Although growth rates of the trees are encouraging, the industry has yet to prove the productivity of areas being planted. There is a role for a professional nursery industry to help address these issues. Infrastructure for the handling of the crop has yet to be established. A key and immediate issue is the stabilization of the inshell crop through drying. Marketing also remains a challenge. Although there are already indications of buyer interest by international food manufacturers such as Ferrero, accessibility of the crop to World markets remains to be demonstrated. The Hazelnut Growers of Oregon, an established agricultural cooperative based in Oregon, USA has established local operations to assist in the development of this emerging industry. It is recruiting grower members through the provision of agronomic information, the organization of basic infrastructure and the eventual purchase and movement of product into its expanding global markets.

HAZELNUT PRODUCTION AND INDUSTRY IN IRAN

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Keywords: Iran, hazelnut industry, production, wild trees

Abstract

Iran is one of the most important and well known centers of origin of most plant species in the world. Presently, wild plants of hazelnut constitute the predominant vegetative cover of many Iranian provinces like Ardabil, Gilan and others. Hazelnut cultivation has a privileged position in relation to the other horticultural crops in the country, because it represents a valuable source from a socio – economical point of view, and also because of its notable compatibility and development potentiality in the other Iranian regions. Comparing the statistical curves of hazelnut production on the basis of regional yields, it becomes possible to deduce conclusions on the factors that caused fluctuations of the yields within the country and in the world during the last decade. In this article, other aspects of the hazelnut situation have been pointed out ,such as: production and cultivation areas, agro ecological regions, present situation, issues and constraints, socio-economic importance of the hazelnut industry, prospects of research and development ,government policy, national service, and research organisms.

Conventional and alternative use of biomasses derived from hazelnut cultivation and processing

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Keywords: thermo-chemical conversion, gasification for power, CHP and polygeneration, pruning

Abstract

Biomass is one of the main sources for energy production; indeed, due to its chemical and physical peculiarities, it can be used very well in thermo chemical processes such as combustion, pyrolysis and gasification.

Furthermore, the considerable variability of bio-fuels that can be produced allows the experimentation of new technologies which, with a higher performance, are able to produce not only heat but also electric power.

On the other hand, due to problems in supply and technology, the main disadvantage of such energetic systems consists in its difficult application in a large scale production.

The present study aims to highlight the possible use of biomasses in small energetic districts such as the area of Viterbo: the exploitation of wood and cellulose biomasses are described, and the possible application with flowing bed technology is considered.

The objective of this study is to technically test the feasibility of a biomass supplied system, taking care of stocks availability and amount, use of the gasification process based on flowing bed technology, chemical characteristic of syngas and energy power production.

Considering the winter trimming of *Corylus avellana* on a surface of 48,7 ha, produced during the 2004/2007 period, the resulting annual amount of biomass ranges from 1.5 to 3.1 t*ha⁻¹ with a mean value of 2.4 t*ha⁻¹.

Considering a *kg of biomass/producible kWe* ratio equal to 1.3, given by the gasification process based on fluidize bed technology, it is possible to estimate a potential production of electric power of 90 MW.

ORAL SESSION N.6

Marketing, Economics and Policies



Chairman: *Mehmet Bozoglu*

AN ECONOMIC EVALUATION OF THE IMPACT OF PLANTING EASTERN FILBERT BLIGHT RESISTANT HAZELNUT CULTIVARS IN OREGON, USA

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Keywords: annual net return, accumulated net returns, net present value, internal rate of return, cash flow analysis, hazelnut establishment and production costs

Abstract

Since 2000, research and development efforts by plant breeders have significantly improved the quality of plant stock available for hazelnut producers. In 2000, trees began to fruit in year 4 producing approximately 68 kg/tree and 1068 kg/tree at full production in year 12. Hazelnut plants on the market today have been selected for earlier and more uniform fruit bearing resulting in 68 kg/tree in year 3 and 1350 kg/tree at full production. In addition to enhanced fruit bearing characteristics, immunity to Eastern Filbert Blight, has been achieved in some hazelnut cultivars. This breakthrough has reduced pesticide applications in hazelnut orchards having a positive impact on the environment and the economic sustainability of producers. In 2000, with the plant stock available then, producers could expect to generate a positive cash flow, gross income minus cash costs, of US\$22 per hectare in year 9, compared to US\$163 in year 5 for the EFB resistant planting available today. A comparison of the cumulative cash flow in year 10, the year all cash cost are recovered in the modern EFB resistant plantings, the EFB resistant planting with a US\$1222 per hectare surplus, and the EFB susceptible planting at -US\$8822, a difference of US\$10044 per hectare. At the end of the establishment period, the EFB immune planting returns US\$7785 per hectare over cash costs to the grower, as compared to -US\$6381 for the EFB susceptible planting, a difference in cumulative cash flow of US\$14166. The EFB resistant varieties available to Oregon hazelnut producer enhanced economic feasibility by reduce cash flow demands.

PRODUCTIVITY AND PROFITABILITY OF TURKISH HAZELNUT PRODUCTION

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Keywords: agricultural productivity, hazelnut production, inheritance law, agricultural subsidy, regional development

Abstract

This paper examines the Turkish Hazelnut Industry in the Black Sea Region in Turkey and identifies the key issues that challenge both the region and the industry. Unsustainable government policies such as price subsidies and absorption of overproduction to maintain the subsidized prices have led to years of market price instability. This paper ascertains that such policies are important in understanding the region's issues but they are also just a beginning. The problems burdening the Turkish hazelnut industry are expansive in scope and complex in nature. This paper explores why the past and current market prices for this crop were/are insufficient for producers by conducting an extensive review of literature pertaining to Turkish Hazelnut Production. A non comprehensive productivity comparison was conducted with other hazelnut producing regions found both within Turkey and outside by using the Turkish Hazelnut Producer Cooperatives Union's (Fiskobirlik) annual national and international production and export data. Based on the findings of such analysis, this paper claims that the problem of unsatisfactory market prices is closely related to farm structure. Using interviews conducted with key industry specialists, having previously done econometric studies and a statistical analysis based on the Turkish Statistical Institute's (Turkstat) 2001 Agriculture Census, this paper investigates the relationship between factors such as: the average farm size per farming unit or number of farm partners, the number of occupations per farmer, the cost of production and productivity. Relatively low productivity, as a result of the declining average farm size in the region, has negative effects on the profitability of hazelnut farming in Turkey. This paper also discusses the major underlying causes of the decline in the average farm size (i.e. inheritance laws) and, in the final section, examines a number of preventative measures and policies that have been implemented by other developing regions.

THE FIRM SIZE, FARM SIZE, AND TRANSACTION COSTS:
THE CASE OF HAZELNUT FARMS IN TURKEY

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Keywords: hazelnut farming, farm size, farm management, monitoring, farm economics

Abstract

This study analyzes the determinants of the size of the hazelnut farms in Turkey within the framework of the theory of firm and transaction costs (the costs of using the inputs necessary for production). This study argues that, for a farm production function, land is a complex input with many transaction cost-increasing interactions with nature. Natural effects, such as land slope and variation in the weather conditions, can increase transaction costs.

This study utilizes two separate data sets in order to test if the predicted relationship between transaction costs and farm size holds. The first data set explores the individual characteristics of hazelnut farmers. The second data set explores the regional farm characteristics across hazelnut production regions. Based on the OLS and IV estimation results, it is found that holding other factors constant higher land slope and higher variation in rainfall cause a decrease in the size of the hazelnut farms. The study offers implications for farm size related policy options that target the inheritance, transfer, and lease of hazelnut farms.

ECONOMICS OF ORGANIC AND CONVENTIONAL HAZELNUT PRODUCTION IN SAMSUN PROVINCE OF TURKEY

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Keywords: economics, organic agriculture, cluster analysis, hazelnut, Turkey

Abstract

Understanding the economics of organic agriculture is crucial for policy makers in order to support organic production, and for producers in order to facilitate the conversion of their lands to organic production.

The aim of this research is to compare organic and conventional hazelnut producers, in terms of their socio-economic characteristics, production systems and economic performance.

The main data were gathered by means of surveys of 64 randomly-selected conventional hazelnut producers and all the organic hazelnut producers (39) living in villages of the Terme district of Samsun, Turkey in 2005.

The results revealed that, as compared to conventional hazelnut producers, organic hazelnut producers were more educated, had larger hazelnut areas, and spent more time on agricultural activities. This research used also cluster analysis to define relatively similar farmers from both production systems, and to compare variables. Organic producers needed more labor, especially hired workers, and used more lime, organic fertilizer and insect traps, while conventional producers used more synthetic inputs. Organic producers had lower costs of production and had an higher income.

It is recommended that the organic producers be supported financially, and assisted by research and extension services in order to produce and use their own inputs, rather than purchasing from outside. They should also be encouraged to establish associations to increase their marketing efficiency.

AGRICULTURAL INFORMATION SYSTEMS AND COMMUNICATION NETWORKS
FOR ORGANIC AND CONVENTIONAL HAZELNUT PRODUCERS
IN SAMSUN PROVINCE OF TURKEY

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Keywords: agricultural information systems, communication networks, organic agriculture, hazelnut, Turkey

Abstract

This research presents an example for the analysis of agricultural information systems (AIS) and communication networks (CN). The information systems and their communication networks for organic and conventional hazelnut producers in Samsun province of Turkey were analyzed and compared in order to identify the problems of the systems and to improve their performance.

Structured interviews were used to collect main data from 64 randomly-selected, conventional hazelnut producers and from all the organic hazelnut producers (39) living in the study area. This research is a longitudinal study; indeed, a similar research was conducted in the same area in order to compare and to show the historical development of the information systems.

The main function of the agricultural information systems was the dissemination of hazelnut-related information. In general, AIS theory and CN illustration presented an holistic approach and helped to understand the strengths and weaknesses of the current systems which were studied. Specifically, the lack of information supports from the institutional (both public and private) and mass media information sources resulted in developing personal (i.e family members, other producers and leader farmers) information sources to exchange information and diffuse technology among the producers within their villages. More functional cooperation and information exchange between personal and institutional information sources are required in order to stimulate conventional hazelnut producers to convert their farms into the organic production system.

POLICY IMPACT ON THE DIFFUSION OF ORGANIC HAZELNUT CULTIVATION IN THE MONTI CIMINI AREA

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Keywords: organic agriculture, environmental policies, hazelnut production

Abstract

The Monti Cimini show environmental and socio-economic characteristics which have determined a noteworthy specialization in the hazelnut and chestnut production. Hazelnut is cultivated in about 10,000 farms, with a total UAA of 18,000 ha and an average production of 35-40,000 t/year, equal to 4-5% of the world's total. Chestnut farms are more than 2,000, with an area of 2,800 ha and an average production of 8,000 t/year, equal to 10-15% of the national total.

In such a particular situation, organic agriculture has undergone an atypical evolution as well, highly influenced by the product market and, above all, by the presence of EU policies for environment and agriculture.

In the Monti Cimini area, the hazelnut farms managed in an organic regime have reached 4% of the total with a UAA of more than 2,300 ha, equal to 13% of the total, in a few years. The organic hazelnut cultivation shows remarkable differences within the area as compared to the conventional one, both from a structural (the average dimension of organic farms is almost four times bigger than the conventional ones) and territorial diffusion point of view. This second diversity is due not only to technical and phytopathological reasons, but also to the widespread presence of chestnut fruit trees. This last cultivation, which is easily managed in an organic regime and benefits from the communitarian aid even if being part of the forest species, is present in the areas where a "dragging" effect towards the organic farming is mainly operative on the hazelnut as well.

In the period examined in this study (1999-2004), the organic chestnut cultivation registered an inverse trend as compared to the hazelnut one; indeed, although it concerns 10% of farms and almost 40% of the area, a contraction was observed, which led to a reduction of 22% in the number of farms and of 11% in the areas.

The aim of the paper, after a detailed description of the evolution of the organic hazelnut and chestnut cultivation in the Monti Cimini area, is to interpret this phenomenon considering the particular spatial and temporal articulation of policies on aid to organic agriculture.

INCOMES AND PROFITABILITY IN THE HAZELNUT FARMS
OF THE AREA OF MONTI CIMINI

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Keywords: income, profitability, representative farms, input prices increase

Abstract

The study assesses the economic impact of recent price changes on the production of hazelnuts in Monti Cimini and Sabatini. The analysis focuses on the conventional hazelnut production and examines the economic data of various typologies of farms that represent the production of that territory. The structural characteristics and the production technologies are reconstructed for each one of those typologies. This defines the framework of revenues, of cost of production and of incomes achieved in the area. The profitability levels, the employment of resources and the impact of the public interventions of public for regulation and for support of the sector are assessed. In particular, the analysis compares the profitability levels in the 2005/2006 period, with the new framework that presents a significant increase in prices of inputs. This identifies the kind of farms that may be more exposed to serious crisis and the ones which, instead, have still interesting possibility of affirmation.

THE EFFECTS OF TURKEY'S ACCESSION TO THE EUROPEAN UNION ON HAZELNUT MARKETS

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Keywords: welfare effects, liberalization, hazelnut market, EU enlargement, partial equilibrium analysis

Abstract

Turkish agricultural policy should be harmonized with the EU Common Agricultural Policy before the accession. It is expected that this harmonization would make important impacts on both Turkey and the EU. As it is well known, Turkey is the major hazelnut producer and the EU is either one of the main producer and importer in the world. In this paper, the welfare effects of liberalizing hazelnut trade between Turkey and the EU is analyzed by applying a partial equilibrium analysis to 1980-2006 data. The results show that liberalization of the hazelnut market and harmonization of the hazelnut policies cause a decrease in hazelnut prices. In spite of the decreasing domestic supply, hazelnut demand would be increased by these low prices both in Turkey and the EU. It is estimated that the EU hazelnut import from Turkey and Turkey's hazelnut import from third countries would be increased. In welfare terms, while hazelnut producers would lose, consumers and taxpayers would gain both in Turkey and the EU. Overall, gains for consumers and taxpayers are estimated to be higher than the losses suffered by suppliers, and therefore net social welfare can be improved by the hazelnut market liberalization. However, Turkey should conform to further issues such as residual food security rules, environmental measures and higher product quality.

THE TRADE EFFECT OF EUROPEAN AFLATOXIN STANDARDS ON TURKISH HAZELNUT EXPORTS

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Keywords: aflatoxin standards, gravity model, food safety, hazelnut trade

Abstract

Turkey is in the first rank for hazelnut export to the European Union (EU) market. The EU has an import regulation for hazelnuts, including aflatoxin standards, which is obeyed compulsorily by importer countries. Therefore, this standard affects mostly Turkish export due to its market share of hazelnut. This study aims to quantify the impact of harmonized aflatoxin standards. Hence, a gravity model is employed to estimate the impact of changes at different levels of the standard which is based on protecting the domestic market in the EU, in contrast with international standards. The analysis is based on trade and regulatory survey data for 15 European countries and Turkey between 1990 and 2005. Empirical results from the study suggest that the implementation of the EU aflatoxin standards has a negative impact on Turkish hazelnut exports to the EU market.